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(Including the Yang-ch'uan Ironworks)

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Chapter Ten. T'ai-yuan Iron and Steel Works (Including the Yang-ch'uan Ironworks)

I. Outline

A. Name of Enterprise

T'ai-yuan Iron and Steel Works

B. Form of Enterprise and Affiliation

It is a state-operated enterprise under the Iron and Steel Industry Control Bureau of the Ministry of Heavy Industry.

C. Location

It is located east of KU-CH'ENG-TS'UN (古城村) (STC 0657/1004/2625), four kilometers from the northern suburbs of T'AI-YUAN, SHANSI Province -- see Chart No 10-1.

D. Plant Area

It covers an area of over 300,000 tsubo. If the grounds of the attached installations such as the hospital, school and workers' housing are included, the total area will be about 700,000 tsubo.

Note: The plant area during the Japanese controlled era was about 80,000 tsubo

E. Plant Layout

See Chart No 10-2

F. Types of Operations

The iron and steel works manufactures pig iron, coke, by-products of coke, and steel. It also carries out rolling, casting and forging operations.

G. Type of Works

It is engaged in the integrated process of steel manufacture

H. Principal Facilities

See Table No 10-1

I. Operational System

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See Table No 10-2

K. Itemized Production and destination of Products

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L. Labor Force

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Note: Total number of workers during the Japanese era was four thousand and several hundred.

M. Various Aspects of the Work's Location

1. Geographical aspect

a. T'AI-YUAN is located in a small basin (elevation, 1,000 meters) along the middle reaches of the FEN Ho, in the central part of SHANSI Province. It is the seat of the Shansi Provincial People's Government. In the latter part of the first half of 1953, the population of this city was about 350,000. The present goal is to build this city into a city with a population of 1,000,000 through town planning in the future.

b. SHANSI Province is separated from HOPEH Province by the T'ai-hsing Mountain Range and from SHENSI Province and HONAN Province by the YELLOW River. These natural boundaries make SHANSI a thorough inland province which lies on a mountaneous plateau with an elevation varying from 600 meters to 3,000 meters.

c. In SHANSI Province, the temperature is generally lower than HOPEH Province. The winter is comparatively long owing to the wind which blows from MONGOLIA every year from April to May, but in summer the heat is extremely severe. This is a typical continental climate. The annual rainfall averages only 500 millimeters and below, and the highest rainfall is registered during July and August. The winter is very dry.

2. Transportation aspects

The North and South Tungpu lines (total length, 866 kilometers) runs through the province. The North Tungpu Line connects with the Chingpao Line and the Shihtai Line links with the Chinghan Line. The North Tungpu Line and the Shihtai Line are standard gauge lines (width of gauge is 1435 millimeters) but the South Tungpu Line is a narrow gauge line (width of gauge is 1067 millimeters). The North and South Tungpu lines are joined between T'AI-YUAN and YU-TZ'U (37°39'N 112°44'E). The conversion of the South Tungpu Line into a standard gauge line and the double tracking of the Shihtai Line are planned under the First Five-Year Plan.

3. Raw material aspects

a. Various underground natural resources were found abundantly from the past in SHANSI Province. Particularly, raw materials for the manufacture of iron (such as iron ore, coal, limestone, gypsum, manganese, fluorite) and various raw materials for refractory materials were deposited abundantly in various parts of the province. The iron ore deposits are dispersed over 20 hsiens, such as WU-T'AI, CH'UN-YANG (春 陽) (STC 2504/7122), T'AI-YUAN, YANG-CH'UAN, LU-AN, etc. It is claimed that the total deposit is 30,000,000 tons. The Yang-ch'uan and Lu-an areas have been famous from the past as pig-iron manufacturing centers of SHANSI.

It is said that the coal deposits, both anthracite and bituminous, are inexhaustible. According to the rudimentary survey conducted by RIHITOHOHEN* in the late 19th Century, the coal deposit was estimated at one hundred and several ten billions of tons. However, the present deposit is said to attain one trillion tons (52 per cent of the coal resources of the nation). Lode outcrops are observed everywhere within the province and the Yang-ch'uan and Ta-t'ung coal mines are famous for these outcrops.

It is said that there are also inexhaustible deposits of limestone and gypsum. In addition, there are rich deposits of high grade manganese, fluorite and raw materials for refractory material such as sekihaku silica, dolomite and alumina shale.

b. However, the iron ore of SHANSI Province belongs to the pocket ore stratum which is peculiar to this province and it is unfavorable for large scale mechanical mining. In addition, the quality of the ore cannot be considered as being good because the iron content is only 40 to 47 per cent. Even the promising Ting-hsiang ore is a flat ore which is considered unfavorable for the manufacture of pig iron.

As a result, Communist CHINA abandoned its plans for large-scale mining in SHANSI Province. Since 1953, Communist CHINA changed its policy so that ore used as raw material by this steel works would be composed almost entirely of ore imported from outside the province. The usage of the ore mined within the province was limited to supplementary selling by the small-scale private miners. There is a possibility that the problem of ore supply will greatly restrict the future development of this steel works.

4. Overall industrial aspect

a. SHANSI Province turned its attention to industrial development since the establishment of the prewar YEN Hsi-shan (STC 7051/6932/1472) Government, and in 1922, it distinguished itself as a model province among the provinces of CHINA under the so-called Shansi version of the Monroe Doctrine. Thereafter, for a period of several years, the domestic industries did not show smooth development owing to the wars between the warlords and peoples' revolutions. However, taking advantage of the Ten-Year Economic Construction Plan of SHANSI* Province devised in 1928 and the establishment of the Northwest Industrial Company in 1932, an epoch-making expansion of each department in industrial mining was started. The main plants that were either constructed or under construction as affiliated plants of the Northwest Industrial Company before the outbreak of the Japan-China Incident in 1937 were as follows:

(1) Northwest (T'AI-YUAN) Steel Mill

(2) Northwest (T'AI-YUAN) Yu-ts'ai Machinery and Tool Plant

(3) Northwest Locomotive Plant

(4) Northwest Ironworks

(5) Northwest Foundry

(6) Northwest Hydraulic Press Plant

(7) Northwest Motor Vehicle Repair Plant

(8) Northwest Electrical Plant

(9) Northwest Chemical Plant

(10) Northwest Coal Mine Plant No 1

(11) Northwest Cement Factory

(12) Northwest Ceramic Plant

(13) Northwest Leather Factory

(14) Northwest Match Factory

(15) Northwest Paper Mill

(16) Northwest Woolen Fabric Mill

These plants were divided into the fields of light heavy and chemical industries.

After the outbreak of the Japan-China Incident, these factories and about 20 affiliated factories of the former Pao-chin Company were placed under the Management of the Hsing-chung Company. With the succeeding establishment of the Shansi Industrial Co, Ltd in 1942, the 36 factories were placed under its administration.

b. In general, these factories were concentrated in T'AI-YUAN and its surrounding districts. This indicates that T'AI-YUAN was being developed as an integrated industrial center, although on a small scale, from before the war. Particularly the fact that the machinery industry was developed to some extent in this district from before the war made this location a favorable site for the T'ai-yuan Iron and Steel Works. After the end of the war and throughout the Chinese Nationalist period, there were hardly any noteworthy developments on these factories. However, after it came under the control of the Chinese Communists and particularly since the commencement of the First Five-Year Plan, the expansion of the machinery industry in the T'ai-yuan District became very conspicuous. It is important to note, however, that although the new machinery plants that were constructed or were under construction during this period were of great importance and priority from the National standpoint, plans for the basic construction of steel works which formed the foundation for the former, were of comparatively small scale. At present, the reasons for this situation is not definitely known, but it appears that one of the reasons was the limitation caused by the raw material situation which had been mentioned previously.

5. Other aspects

It is observed that since the T'ai-yuan Iron and Steel Works is situated within the second line (west of the Ching-han Line) of the so-called national defense zone of Communist CHINA, it commands a relatively favorable position as a national defense industry as compared to the other iron and steel centers presently located on the continent of CHINA.

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N. History

1. Outline

Civil wars occurred in succession from the latter part of the Ch'ing Dynasty. Each area was controlled by a war lord and the situation was such that only the fittest (strongest) survived. SHANSI Province during 1920 was controlled by General YEN-Shi-shan. General HAN Fu-ch'u (STC 3352/1788/3255) controlled SHANTUNG Province beyond NIANG-TZU-KUAN (37°59'N 113°54'E).

General YEN advocated the Shansi version of the Monroe Doctrine and strove to expand the provincial power under the banner of "Save the country through construction and production". First of all, YEN aimed at developing the rich underground resources within the province and devised a plan to construct 36 various types of factories with the T'ai-yuan District as the nucleus. This plan was inaugurated in 1928 as a Ten-Year Economic Construction Plan through technical cooperation with GERMANY.

The Northwest (T'AI-YUAN) Steel Mill, the predecessor of the present steel works, was constructed in 1935 as a part of this plan and it was a provincially-operated ironworks engaged in the integrated process of steel manufacture.

In November 1937, the T'ai-yuan Steel Mill was taken over by the Japanese Army in the midst of its construction. Thereafter, its construction was continued by the Japanese and by late 1941 the mill commenced full-scale operation on rolling, steel manufacturing and pig-iron manufacturing.

After the end of World War II, the mill was taken over by the Chinese Nationalist Government and the administration of the mill again return to the YEN Shi-shan Government (Shansi Provincial Government). However, on 19 Apr 49, the mill was taken over by the Chinese Communist Army. With the establishment of the Chinese Peoples' Republic on 1 Oct 49, the mill commenced operation as a state-operated enterprise under the direct jurisdiction of the Iron and Steel Industry Control Bureau of the Ministry of Heavy Industry, the state in which it still remains today.

2. Administrative transformation

a. Before the war (1935 to November 1937)

(1) Name of enterprise: Northwest (T'ai-yuan) Steel Mill

(2) Form of enterprise: operated by SHANSI Province

(3) Affiliation: Northwest Industrial Company

(4) Capital: Started with a capital of 2,500,000 yuan

(5) Managing executive: P'ENG T'u-hung (STC 1756/0960/1738), general manager of the company

(6) Operation: facilities under construction; not in operation

b. During the war (November 1937 to August 1945)

(1) Japanese Army controlled era (November 1937 to September 1942)

(a) Name of enterprise: Shansi Iron Mining Industry Plant No 6 of the North China Army.

(b) Form of enterprise: Army controlled plant

(c) Affiliation: Japanese Army; managed by the Hsing-Chung Company.

(d) Managing executive: OTA Fumio (太田文雄), president; TAKAHASHI Tetsuzo (高橋鉄蔵), plant superintendent

(e) Operation: construction of facilities completed; integrated process of steel manufacture (including mining) established

(2) Japanese controlled era (October 1942 to August 1945)

(a) Name of enterprise: T'ai-yuan Ironworks

(b) Form of enterprise: private corporation

(c) Affiliation: Shansi Industrial Co, Ltd (under the control of the North China Development Co, Ltd)

(d) Capital: capital of the Shansi Industrial Co, Ltd in October 1942, 80,000,000 yen

(e) Managing executive: first president of the company, OTA Fumio; second president, KAWAMOTO Daisaku (河本大作); mill superintendent, TAKAHASHI Tetsuzo.

(f) Operation: integrated process of steel manufacture; commenced small section rolling operation

c. After the end of the war (August 1945 to April 1949)

(1) Name of enterprise: T'ai-yuan Steel Mill

(2) Form of enterprise: operated by SHANSI Province

(3) Affiliation: Northwest Industrial Company

(4) Managing executive: P'ENG T'u-hung, general manager of the company; LIANG Hai-chiao (STC 2733/3189/4255), mill superintendent

(5) Operation: Same as before the war

Note: 1. The seizure of the mill by the Chinese Nationalist Government after the end of the war was conducted very smoothly and the

administration after the seizure was almost similar to that of the Japanese era.

2. General manager P'ENG T'u-hung is a graduate of the Waseda University of JAPAN, and was reinstated to the prewar position (general manager). Nearly all of the executives in the various affiliated enterprises of the Northwest Industrial Company during this period were confidents of P'ENG T'u-hung.

3. There were about 130 Japanese (of whom 30 came from the Ching-chin District) detained at this mill after the end of the war and these Japanese were accorded good treatment as technicians.

4. It is claimed that throughout the period before and after the end of World War II, TAKAHASHI Tetsuzo, mill superintendent during Japanese control, had been the outstanding person of the mill from the standpoint of technical, managerial and guiding abilities. At the beginning of the Japan-China Incident, he was despatched from the Pen-ch'i-hu Coal and Iron Company which was affiliated to the Okura concern at that time. In 1937, he took charge of the seizure of this mill. Since then, despite the changes in managerial organization and personnel, he remained as mill superintendent until the end of the war. Even after the war, he participated in important internal affairs of the mill during the period of Chinese Nationalist Management as well as the early period of the Chinese Communist management. Thereafter, he was relieved of his position as a result of the antirevolutionary suppression movement and was sent to YUNG-NIEN (36°42'N 114°43'E) in June 1951. On 28 Oct 52, he passed away as a result of illness.

d. Period of Chinese Communist control (since April 1949)

(1) North China People's Government era (April to September 1949)

(a) Name of enterprise: T'ai-yuan Steel Mill

(b) Form of enterprise: Public enterprise of Communist CHINA.

(c) Affiliation: Affiliated with the North China Iron and Steel Company under the jurisdiction of the North China People's Government State-operated Enterprise Department.

(d) Managing executives: LAI Chi-fa (STC 6351/7139/4099), person in charge of the seizure and control of the company; CHANG P'ei-hung (STC 1728/1014/3163), person in charge of the seizure and control of the mill.

(e) Operation: Same as before the war.

(2) After the establishment of the Central People's Government (since October 1949)

(a) Name of enterprise: T'ai-yuan Iron and Steel Works

(b) Form of enterprise: State-operated enterprise

(c) Affiliation: Iron and Steel Industry Control Bureau of the Ministry of Heavy Industry

(d) Managing executives: LI Fei-p'ing (STC 2621/2431/1627), first superintendent (appointed October 1949); PAI Hao (STC 4101/3181), second superintendent (appointed October 1952)

(e) Operation: Integrated process of steel manufacture (Excluding mining); commenced operation on sheet rolling, electric furnace steel manufacturing and forging

Note: 1. In April 1949, the Northwest Industrial Company was seized and placed under the control of the Light and Heavy Industry Seizure and Control Team (headed by LAI Chi-fa) of the T'ai-yuan City Military Control Committee. At that time, the T'ai-yuan Iron and Steel Works was seized and controlled by CHANG P'ei-hung, representative of the Army, KUO Ch'i-ying (STC 6753/1142/2019), deputy representative, and some 10-odd persons.

2. After the seizure by the Chinese Communists, the steel works, as a North China People's Government public enterprise, came under the Affiliation of the North China Iron and Steel Company which was directly controlled by the North China People's Government Public Enterprise Department.

3. With the establishment of the Central People's Government in October 1949, the steel works came under the jurisdiction of the Iron and Steel Industry Control Bureau of the Ministry of Heavy Industry and was renamed the State-operated T'ai-yuan Iron and Steel Works.

4. The managing staff during Chinese Nationalist control remained in its position even after the Chinese Communists took control, but the actual guiding power was taken away. Thereafter, through purges and antirevolutionary suppression movements the managing staff was either gradually removed or arrested and subjected to thought indoctrination.

3. Alteration of facilities

a. In November 1937 when the steel mill was taken over by the Japanese Army, the productive facilities of the steel mill were still incomplete with the exception of the workshop and a part of the power plant. On the whole, 60 to 90 per cent of the steel mill was in the process of construction.

b. In 1938, after the arrival of Japanese technicians, workers of the steel mill were assembled and their efforts were concentrated in the various construction projects. As a result, the power plant facilities (two 5,000 kilowatt generators) within the steel mill was completed in summer 1939. In November of the same year, blast furnace No 1 (rated capacity, 40 tons) was completed and fired. In July 1940, operation of the coking plant commenced and in August, the by-product plant was established. Furthermore, in November 1940, blast furnace No 2 (rated capacity, 120 tons) was fired and the manufacture of pig iron went into full operation. Moreover, in September 1941, the open-hearth furnace plant and the medium bar mill commenced operation to bring about the establishment of an integrated process of steel manufacture.

In late 1943, a small bar mill was constructed as an affiliated plant of the medium bar mill. At about the same time, construction of blast furnaces No 3 and No 4 commenced (both were small types with a rated capacity of 40 tons). Owing to the progress of war, steps were taken to meet the sudden increase in the local iron and steel demands, but in late 1944, the furnaces were bombed by the US Air Force stationed in CHINA. As a result, the small furnaces were destroyed by the bombing and the operational efficiency throughout the other departments dropped conspicuously.

c. Since the end of the war, there has been no big change in the facilities and on the departments of the steel mill throughout the Chinese Nationalist era (operated by SHANSI Province). During this period, the managing authorities adopted measures for improving and increasing various facilities in view of strengthening the domestic iron and steel self-sustenance standard. However, the supply of necessary materials became difficult following the intensification of the civil war between the Chinese Nationalists and the Chinese Communists, and the work on large-scale projects either did not commence or ceased soon after it commenced. The planning or partial work that had commenced on the main projects were renovations of the blast furnaces and open-hearth furnaces and the construction of a new foundry.

d. After seizure by the Chinese Communists, the plan to fully equip and expand the steel works was given priority with the objective of making the steel works the largest integrated iron and steel enterprise in CHINA proper. This steel works was favored by the fact that it was an inland iron manufacturing site. First of all, the pig-iron manufacturing facilities were mechanized in 1951, and in 1952, steel manufacturing plant (open-hearth furnaces and electric furnaces), small bar mill, sheet mill, coke plant, by-products plant, workshops, and refractory material plant were newly constructed or renovated. After 1953, the preparation for the First Five-Year Plan was undertaken. Furthermore, in spring 1953, basic constructions for the electric furnace and foundry were in progress.

During the foregoing procedure, the coastal iron manufacturing facilities from SHANGHAI and T'ANG-SHAN were gradually being transferred to this works with the intensification of the Korean War. This move by the Chinese Communists can be said to be worthy of attention in that it reveals the importance of this steel works from the standpoint of its location and a part of the Chinese Communist policy trend toward the construction of inland based iron and steel industry.

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4. Production changes

a. Prior to the outbreak of the Japan-China Incident, this steel mill was not in operation.

b. In August 1941, around the time the integrated process of steel manufacture was established, the production capacities of the facilities were as follows:

(1) Pig iron: 60,000 tons a year

(2) Steel ingot: 50,000 tons a year

(3) Steel stock: 45,000 tons a year

In 1942 and 1943, each department was operating in full under normal conditions. The peak production year before the end of the war was 1942.

c. Since the seizure of the steel mill by the Chinese Nationalist authorities was conducted in an orderly manner after the war's end, the transfer of control of each department was made while normal operation was continued, except for the coking furnace which stopped operating for several days. However, after the wheat harvest operation of spring 1948, the pressure of the Chinese Communist Army suddenly increased. In autumn of the same year, blast furnace No 2 ceased operating because of the lack of raw materials and only blast furnace No 1 was barely able to continue its operation.

d. After the seizure by the Chinese Communists, the new management was busily occupied for a time with familiarizing itself with the operation of the steel works and with recalling of the workers to the works, reorganizing the workers, and giving political and ideological training to the workers. In the meantime, an irregular operation was carried on for training purposes. However, since the raw material situation turned favorable thereafter, efforts were directed toward a full scale rehabilitation of facilities and normalization of operation from August to September 1949.

It seemed that the production activities in the early stage was mainly aimed at the restoration of production to the level of the past peak and at the technical training of workers. However, with the improvement of production thereafter, preparations were made for the First Five-Year Plan commencing from 1953 by unfolding various forms of socialistic production struggles and by gradually adopting the operational system of the USSR.

II. Coke and By-products Department

A. History

1. From the beginning of the construction of the T'ai-yuan Steel Mill before the war, plans had already been drawn up for the construction of the coking plant as a priority had for establishing an integrated process of steel manufacture. Orders for the blueprint of coke oven No 1 and for the coking plant had already been placed with a German trading company before the outbreak of the Japan-China Incident.

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2. By the time of the occupation by the Japanese Army, the construction of facilities had progressed to the following extent:

a. Coking unit: 90 per cent completed.

b. By-products plant: 60 to 80 per cent completed, with the exception of the gas suction facilities.

3. Facilities under construction consisted of coal washing, coke manufacturing, suction and distribution of gas, gas liquid treating, and by-product recovery facilities. As for the scale, these facilities were capable of handling 360 tons of raw material a day that were charged into the 36 ovens of the coking unit.

4. With the firing of blast furnace No 1 about that time, the completion of the coking unit was an urgent matter. For the time being, coke produced by the heap carbonization method at HSIEN-KANG-CHEN (38°53'N 112°32'E) (130 kilometers north of T'AI-YUAN) on the North Tungpu Line was used in blast furnace No 1. However, since the raw material for this coke consisted of unwashed coal, the ash content was high and affected the output of pig iron. Therefore, raising the quality of coke through the use of mechanical oven became an urgent matter.

5. Thus, the construction of the coke plant progressed on a priority basis. The plants completed in 1940 and placed in operation were as follows:

a. Coke oven No 1: Completed in July

b. Ammonium sulphate plant and tar plant: Completed in August

c. Benzol plant: Completed in September

6. The superior coking coal produced in WU-TA'I Hsien (130 kilometers NNE of T'AI-YUAN) seemed to have been anticipated for use as raw material in to the prewar plan. However, owing to the aggravation of the lack of public peace and order since coming under Japanese control, and moreover to the lack of inconvenient transportation, the use of raw coal produced in HSIEN-KANG-CHEN was decided upon and large-scale mining was conducted. But, this coal was easily weathered and at the same time, even the bony coal (mostly clay shale) became pulverized after about one month of storage. As a result of operations, it became clear that the lowering of ash content could not be easily accomplished even though the coal was washed with the facilities of this plant. Therefore, the use of Hsien-kang-chen Coal was suspended after wasting a tremendous amount of labor and expense.

After making a survey of the coal to be used as raw material, the coking coal produced throughout the area along the South Tungpu Line was selected. The main source of supply was the Fu-chia-t'an coal mine (130 kilometers southwest of T'AI-YUAN) operated by the Shansi Coal Mining Co, Ltd. At the same time, coal mined privately at CHIEH-HSIU (36°58'N 111°54'E), HUNG-TUNG (36°15'N 111°42'E), HSIAO-I (37°05'N 111°47'E) and NAN-KUAN-CHEN (STC 0589/7070/6966) (all these areas are located along the South Tungpu Line) were also purchased and used. Under Japanese management, the actual production of superior coke commenced after spring 1941.

7. At the beginning of the operation, there was a shortage of skilled workers particularly in heating work, and a great turnover in workers was caused by strifes among workers of different plants. As a result, normal operation began after late 1941. Thereafter, production gradually increased because of the gradual increase of Japanese employees and as a result of their guidance. In 1942, the highest production result was attained.

8. In 1944, when two small blast furnaces (rated capacity of one furnace, 40 tons) were additionally installed, the installation of mechanical ovens was postponed and 50 clamp burning ovens were installed instead in the open area within the steel works (later, the number of clamp burning ovens were increased to 90). Due to the shortage of coal-washing facilities at that time, unwashed coal was used. Therefore, the ash content was high and the coke extraction rate was poor, and the operational result of the small blast furnaces was unsatisfactory. In the latter part of 1944, these furnaces were bombed by the US Air Force stationed in CHINA and their operation ceased.

9. Aside from the above construction projects, plans were drawn up for the construction of coal washing plant No 2 and coke oven No 2, and the expansion of the by-products plant. However, the project hardly progressed owing to material shortages caused by the war and the deterioration of public peace and order. Immediately before the end of the war, only the foundations for the coal tower and coke oven No 2 had been completed. The new construction plan called for the construction of one battery of coke ovens (daily capacity of lump coke, 200 tons) and one coal washer (daily capacity of clean coal, 1,000 tons).

10. During the beginning of Chinese Nationalist control at the war's end, the operation result was very poor because of the repatriation of a large number of Japanese workers and because of the ill-feeling expressed toward the Japanese technicians who remained behind. Thereafter, owing to instructions from higher authorities and increased confidence in the technical skill of the Japanese, production gradually began to recover. However, with the intensification of the civil war between the Chinese Nationalists and Chinese Communists which broke out soon thereafter, production again started to decline. During this period plans for the construction of facilities which had been drawn up during the Japanese management were put into execution. However, only the upper slab of the base for coke oven No 2 had been constructed when the entire construction operation ceased following the final attack by the Chinese Communist Army on 19 Apr 49.

11. Rehabilitation work commenced immediately after the Chinese Communists came into control and in October 1949 operation of the entire plant was achieved. In February 1950, the Construction Engineering Office was newly established and the production department and the construction department were set up separately. The coking department was entrusted with the construction work on the unfinished coal washing plant No 2 (daily capacity of clean coal, 1,200 tons), the coking plant No 2 (daily capacity of lump coke, 400 tons) and the attached gas washing facilities. In April of the same year, bricklaying of the coke oven commenced and was completed in October. In late 1950, engineering work for the foundation of the coal washing plant was stressed, but the progress of the project slowed down because of the effect of the Korean War. The construction of both plants was finally completed in September 1952.

B. Plant Layout

See Chart No 10-6

C. Coke Plant

1. Affiliation and number of plants

a. Affiliation: Coking Department of the Production Office of the T'ai-yuan Iron and Steel Works

b. Number of plants: four (at the end of the first quarter of 1953)

(1) Coal Washing Plant No 1 (unused)

(2) Coal Washing Plant No 2 (in operation)

(3) Coke Plant No 1 (in operation)

(4) Coke Plant No 2 (in operation)

2. Facility

a. Layout of plant facilities -- see Chart No 10-6

b. Equipment of Coal Washing Plant No 1 -- see Table No 10-5

c. Equipment of Coal Washing Plant No 2 -- see Table No 10-6

d. Equipment of Coke Plant No 1 -- see Table No 10-7

e. Equipment of Coke Plant No 2 -- see Table No 10-8

Note: 1. Coal Washing Plant No 1 stopped operating when Coal Washing Plant No 2 began operating in September 1952.

2. The structure of coke oven No 1 is similar to the Otto type. However, the regenerative effect is slightly poorer than the Otto type. It was after the outbreak of the Pacific War that the furnace was identified as a HINZERUMAN* type and this was verified when the CH'AN-CH'EN-YANG-HSING (STC 4407/5256/3152/5887), a German trading company which was located in TIENTSIN at that time, requested patent fee for the furnace. This incident ascertained that this furnace was designed by a German engineer at the request by YEN Hsi-shan before the Japan-China Incident and it was designed according to the HINZERUMAN* type.

3. Coke oven No 2 was completed and commenced operation in September 1952. Owing to the space limitations at the site, the number of ovens was restricted to 30. Also, the type of oven was similar to coke oven No 1 since its completion was hurried. However, see Tables No 10-7 and No 10-8 for details of coke oven No 2 that are different from coke oven No 1.

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3. Improvement and augmentation of coal washing facilities

The following improvements and augmentation of facilities of the new Coal Washing Plant No 2 following its construction were observed. Particularly, a series of mechanization was carried out to conserve manpower.

a. Increase in the coal transit capacity

The coal transit capacity was increased by more than three times through the utilization of belt conveyors.

b. Construction of a new ungraded coal siever and increase of the crushing capacity

A new siever was constructed and the processing capacity of the ungraded coal crusher was increased by three times.

c. Utilization of the Baum coal washer

The jig coal washer that had a poor efficiency was replaced by the Baum washer. As a result, the coal washing capacity increased 2.7 times.

d. Construction of new dewatering tanks

The dewatering seiver of the past was replaced by dewatering bucket elevators. Twelve new dewatering tanks (capacity of each tank, 150 tons) was constructed to conserve manpower.

e. Others

Installation of a new pulverizer, drainage pond and belt conveyer for the level piling of ungraded coal was carried out. Moreover, in April 1953, the installation of an additional dewatering bucket conveyer was being planned.

4. Improvement and augmentation of coking facilities

Improvements and augmentations observed on the facilities of coke oven No 2 following its construction were as follows:

a. Supplementation of fuel gas supply

Aside from the coke gas that had been used up to now, the usage of blast furnace gas had also been achieved. However, in spring 1953, the piping arrangement of blast furnace gas was still in the planning stage and construction had not as yet started.

b. Prevention of gas escape

The diameter of the uptake pipe was the same as that of coke oven No 1. However, a steam injector was installed in the lower part of the uptake pipe. During the charging of coal, this injector was opened to lead the gas and thus prevent gas from escaping. Also, the gas pipe which is connected to the dry main was changed to the Otto type which seals the gas pipe with water by the rotation of a dumper. This setup will cut off the gas pipe completely from the oven after the carbonization process.

In addition, automatic pressure regulators were expected to be installed in spring 1953 at the junction point of the dry main and the intake main, and in the flues.

c. Completion of other attached facilities

The coal tower, the electric charging car running above the furnace, electric coke guide, coke quenching facility, coke wharf, crusher, coke seiving yard, coke storage bin and belt conveyors linking these facilities were completed and a continuous mechanized operational process was attained. Also, installation of additional coke guides and the expansion of the coke wharf were contemplated in the expansion plan which was being drafted in April 1953.

5. Defects of equipment from the standpoint of capacity and layout

a. Coal washer No 1 (jigger-type with a coal washing capacity of 30 tons an hour) was not in operation since September 1952 owing to inefficiency of the pulverized coal recovery equipment and incomplete mechanization of the coal transit equipment. It is only natural that these equipments necessitate improvements before coke ovens No 1 and No 2 can operate in full.

b. In general, Shansi coal is brittle and crumbles easily and a large area is necessary for recovering pulverized coal. This necessitates tremendous labor power for conducting dewatering operation.

c. Coke oven No 1 was fired in July 1940. Owing to its age, a major improvement is necessary in the near future. (The life of an oven was estimated at 15 years during the Japanese management).

In this case, the construction of coke oven No 3 may become necessary. There were rumors about the construction plan for coke oven No 3 to cope with the increase in the pig-iron manufacturing capacity. It is also judged that the necessity of improving coke oven No 1 will further promote the need for the construction of coke oven No 3.

d. Aside from the attached facilities, no technical improvement was observed on coke oven No 2. This was due to the fact that the completion of the oven was hurried at the time of its construction and thus improvements on the structure of the furnace had to be sacrificed.

e. Owing to space limitations at the site, coke oven No 2 was restricted to 30 ovens. However, even in the case of coke oven No 3, the facilities will be handicapped by cramped disposition and limited ground site owing to the demand for expanding the by-products plant.

It is presumed that the initial plans for the construction of coal washer No 2 was changed and the washer was installed at a point a considerable distance from the originally planned site as a result of considerations of such conditions of this area.

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f. Since the raw coal storage yard of Coal Washing Plant No 2 was small, there was a plan for the construction of a reinforced concrete coal bin capable of storing 10,000 to 15,000 tons of coal and a bridge crane with a capacity of 100 tons an hour. However, in spring 1953, the plan still had not been carried out. At that time, the head of the Basic Construction Office of the steel works hoped to order this gantry crane from the Ishikawajima Heavy Industry Co, Ltd of JAPAN.

6. Coordination of facilities

It is claimed that the construction of coke oven No 2 in September 1952 was to cope with the plan for increasing pig iron production. However, the goal for lump coke output as called for in the plan for 1953 was set at 290,000 tons. This goal for lump coke output is more than three times that of the peak period under Japanese management and the amount is sufficient to produce about 250,000 tons of pig iron as long as production is based on the present rate of heat control (coke ratio of 1.13 [TN Sic.]). This will leave a considerable surplus judging from the pig iron output called for in the plan for 1953 (15,250 tons) and the pig iron output of 200,000 tons (goal) after the end of the first-phase basic construction of this steel works. Thus, it is judged that outside sale of the product had been calculated in the plan.

It is judged that this tendency (the tendency toward a relative surplus of coking facilities over pig iron manufacturing facilities) also continues to exist in the second-phase basic construction plan of this steel works and the construction of coke oven No 3 based on a pig-iron output of 300,000 tons is being planned.

7. Coal washing process

a. Operational process of Coal Washing Plant No 1 -- see Chart No 10-7.

The coal transported from the mine on freight cars is unloaded in the coal yard (level piling) from where it is hauled to a coal bin by a small coal car when needed.

The coal bin is also known as the distribution bin. The coal placed in the bin goes into the feeding machine located in the lower part of the bin, and this machine regulates the supply of coal to the conveyer running to the crusher where it is crushed to the size of about 25 millimeters.

The crushed coal is sent to the washer by means of bucket elevator. The washed coal then goes through the shaking dewatering machine and to the pulverizer and is pulverized to the size of five millimeters or smaller. From here, the coal is sent to the washed coal storage yard by means of a bucket elevator.

The bony coal is sent from the cutter to the bony coal bin by a bucket elevator. Most of the coal is loaded on freight cars and hauled to the disposal area.

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The coal from the Shansi area is generally brittle and crumbles easily. Since the upper and lower dewatering sieves (diameter of the aperture in the dewatering machine is six millimeters) is about the same, an immense area is necessary for the pulverized coal recovery settling pond, and a great amount of labor power is necessary for conducting dewatering operations. Therefore, its effect on coal washing operation is great and it frequently brings about disruptions. Especially in winter, the operation is sometimes hampered by freezing. Thus the mechanization of operation was planned, but this plan was not carried out. The operation of Coal Washing Plant No 1 was suspended since Coal Washing Plant No 2 went into operation in September 1952. The facilities of Coal Washing Plant No 2 were idle at the end of the first quarter of 1953.

b. Operational process of Coal Washing Plant No 2 — see Chart No 10-8.

Details on the operational process of this plant will be omitted because they are similar to that of Coal Washing Plant No 1.

8. Coking process

a. Processing operations at Coke Plant No 1

Clean coal, which was processed at the coal washing plant, is mixed with coal slurry, which was hauled out from the settling pond, and then loaded onto one-ton coal supply cars. It is then hoisted to the top of the coke oven by means of inclined tracks and charged into the oven.

In charging clean coal into the oven there are two charging methods; one from the top and the other from the side of the oven. In charging from the top, doors on both sides of the oven are opened and coke within the oven is pushed out. The doors are then closed and clean coal is charged from four charging inlets on the top of the oven. In charging from the side a stamp mill which is installed on the coke pusher side is used. First, the door on the coke quencher side is closed and stamped clean coal is sent into the oven by means of a charging rack from the coke pusher side. Subsequently, the charged coal is held in place and only the charging rack is withdrawn. The door on the coke pusher side is then closed and sealed.

The gas which has burned in 19 combustion apparatus passes through a pair of upper flues to the other two combustion chambers. The gas then heats the bricks in a regenerator and passes to the chimney flue through a chimney flue valve. On this occasion, another regenerator preheats the air for heating purpose. This process takes place every 30 minutes. Following this process, the red-hot coke is pushed out to a quenching platform, which is located on the same level as the oven base, by means of a coke pusher and quenched with water sprinkled by the workers.

After quenching, the coke is loaded onto freight cars and transported to the coke dump. However, this plant is not equipped with pulverizing facilities and coke is pulverized by laborers before being charged into blast furnaces.

The gas produced is accumulated in the dry main and it is cooled by liquid ammonia and sent through a suction main to the by-products plant where tar contents are removed. The gas is then returned to the dry main and used as coke-oven fuel.

b. Processing operations at Coke Plant No 2 -- see Charts No 10-9 and No 10-10.

With the exception that accessory facilities as a whole are mechanized, the methods used does not differ much from that practiced at Coke Plant No 1. Raw material is charged from the top of the ovens by means of electric-driven lorries.

Red-hot coke, which is withdrawn from the oven, is pushed onto the coke guide (electric car) located on the same level as the oven bottom. It is then reloaded to quenching cars towed by a steam locomotive (planned to be replaced by an electric locomotive in the future) and transported to the point under the quenching tower to be quenched.

Quenched coke is transferred to a belt conveyor at the coke wharf. It is transported through an intermediate room to the coke tower and hauled by electric car to a point directly under the ore bins where it awaits charging into blast furnaces.

9. Special features in the operation

a. The most unique feature is in the raising of the quality of processed coal through improvement of the ash specification. Lowering of the recovery rate through the washing process, however, is prevented by perfecting the facilities for the recovery of the coal slurry.

b. Consideration is being given to raise the dryness of the processed coal and at the same time the difficulty in completely extracting moisture contents is being covered by increasing the charging quantity of coal (11 tons of coal for the normal 10 tons).

c. Gas pressure and regulation of temperature in the coke oven

(1) Pressure for supplying the heating gas: 60 to 100 millimeters on the water column

(2) The temperature of combustion chamber: about 1,250 degrees Centigrade

(3) The temperature of the carbonization chamber: 1,000 to 1,100 degrees Centigrade

(4) The temperature of gas which passed through the regenerator is about 300 degrees Centigrade and the gas is sucked into the chimney flue at a pressure of about five millimeters on the water column.

(5) The temperature of waste gas in the chimney is about 230 degrees Centigrade and the absorption pressure is about 15 millimeters on the water column.

10. Raw materials

a. Consumption of raw coal -- see Table No 10-10.

b. Supply sources of raw coal

(1) Japanese era

Fu-chia-t'an Coal and Hsi-shan Coal of the Shansi Coal Mining Office were mainly used. Also, coal from private mines such as the Chieh-hsiu, Hung-tung, Hsiao-i, and Nan-kuan-chen mines along the South T'ung-p'u Line was occasionally used.

(2) Chinese Communist era

Fu-chia-t'an Coal, which is a superior coking coal, and Hsi-shan Coal, which is a semicoking coal, are mixed and used. Calculating from the planned output of coke for 1953, the amount of raw coal needed for that year was about

480,000 tons. Of this amount, the consumption of Fu-chia-t'an Coal and Hsi-shan Coal is estimated to have been 216,000 tons and 264,000 tons, respectively.

Note: Ta-t'ung Coal is widely used for general purposes such as for power generation and for the gas producers.

c. Supply and demand of raw coal

At the end of the first quarter of 1953, the supply and demand of raw coal was generally balanced and there was no particular shortage.

d. Transportation of raw coal

(1) Hsi-shan Coal is transported from PAI-CHIA-CHUANG to this iron and steel works over the standard gauge railroad for a distance of about 20 kilometers by way of the Hsin-ch'eng Railroad Station.

(2) Fu-chia-t'an Coal is transported to this iron and steel works over the South T'ung-p'u Line (narrow gauge) for a distance of about 200 kilometers by way of the T'ai-Yuan North Station.

e. Proportion of raw coal

(1) Hsi-shan Coal (semicoking coal): 55 per cent

(2) Fu-chia-t'an Coal (superior coking coal): 45 per cent

f. Amount of raw coal charged

During the Japanese era, the amount of raw coal charged into each oven was 10 tons, in accordance with the rated capacity. After the Chinese Communists took control, it was gradually increased for the purpose of higher production. In 1951 it was increased to 10.5 tons and after 1952, it was increased to 11 tons, which became the standard amount to be charged.

11. Output of washed coal

a. Annual output -- see Table No 10-10.

From September 1952, coal washer No 2 was put into operation and the output of washed coal was remarkably increased. Coal washer No 1 has not been in operation since then.

b. Destination of washed coal

It is mostly used for coke ovens within this iron and steel works. Since coal washer No 1 was out of operation, coal washer No 2 has been taking care of the washed coal for both coke ovens No 1 and No 2. A very limited amount of surplus washed coal is being processed by heap carbonization at the by-products plant for outside sales.

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From the Japanese era, a part of the bony coal has been mixed into the fuel for boiler No 2 and has also been distributed to the workers as fuel for domestic use. However, most of the bony coal has been thrown away.

c. Composition of washed coal -- see Table No 10-9.

d. Recovery rate of washed coal

Prior to Chinese Communist control, the recovery rate of washed coal was about 80 per cent because the specifications were low.

After late 1951 following Chinese Communist control, the specifications were raised and as a result, the recovery rate temporarily dropped to 65 to 70 per cent. However, with the raising of the quality of raw coal and recovery of the coal slurry, the recovery rate soon jumped to about 85 per cent.

12. Coke production

a. Daily output

(1) Japanese era

The daily output of lump coke from coke oven No 1 was about 230 tons.

$$10 \text{ tons} \times 0.68 - 0.70 \times 36 \times \frac{24 \text{ hrs}}{24 \text{ hrs}} \times 90 \text{ per cent} \fallingdotseq 228 \text{ to } 237 \text{ tons}$$

Amount charged to each oven	Coke yield	Number of ovens	Coking frequency in one day	Yield rate of lump coke

(2) Chinese Communist era

The planned daily output for 1953 is 450 tons from coke oven No 1 and 378 tons from coke oven No 2, making a total of 828 tons.

(a) Coke oven No 1

$$11 \text{ tons} \times 0.8 \times 36 \times \frac{24 \text{ hours}}{16 \text{ hours}} \times 0.95 \fallingdotseq 450 \text{ tons}$$

Amount charged to each oven	Recovery rate	Number of ovens	Coking frequency in a day	Yield rate of lump coke

(b) Coke oven No 2

$$11 \text{ tons} \times 0.78 \times 30 \times \frac{24 \text{ hours}}{15 \text{ hours}} \times 0.92 \fallingdotseq 378 \text{ tons}$$

Amount charged to each oven	Recovery rate	Number of ovens	Coking frequency in a day	Yield rate of lump coke

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b. Annual output

(1) Mechanical ovens -- see Table No 10-10.

In considering the output of coke oven No 1 which has been in operation from the Japanese era, its planned output for 1953 was about twice (159,726 tons) the output of the peak year (82,530 tons of lump coke in 1942) in prewar days. The planned output for 1953 was a total of 290,000 tons of lump coke for coke ovens No 1 and No 2. The breakdown had been computed as follows:

(a) Coke oven No 1

11 tons	x 36	x $\frac{24 \text{ hours}}{16 \text{ hours}}$	x 365	x 99 per cent	x (80 per cent	- 5 per cent)
Amount charged	Number of ovens	Coking frequency in a day	Number of days in the calendar year	Operation efficiency	Recovery rate	Rate of fine coke

≒ 159,726 tons

(b) Coke oven No 2

11 tons	x 30	x $\frac{24 \text{ hours}}{15 \text{ hours}}$	x 365	x 99.2 per cent	x (77 per cent	- 8 per cent)
Amount charged	Number of ovens	Coking frequency in a day	Number of days in the calendar year	Operation efficiency	Recovery rate	Rate of fine coke

≒ 131,884 tons

Note: To be exact, the final figures shown above should be multiplied by the percentage of the products meeting specifications.

(2) Clamp burning ovens

Since there was a shortage of lump coke before the war's end, about 15,000 tons of clamp coke was produced from unwashed coal every year. However, following Chinese Communist control, a very limited amount of clamp coke is being produced from washed coal at the by-products plant. The actual output of clamp coke in 1952 was about 2,400 tons.

c. Destination of coke

(1) Throughout the Japanese era and the early phase of Chinese Communist control, coke output was generally insufficient. The entire coke produced here was therefore used within this iron and steel works.

(2) During the period from 1950 to 1951 a part of the coke was occasionally shipped to SHIH-CHING-SHAN and SHANGHAI. However, this was only for a short period and it was soon discontinued.

(3) Following the commencement of operation of coke oven No 2 in September 1952, there was a surplus in the coke supply and a certain amount of coke was sold to the outside. After September of that year coke was shipped to the outside at a rate of one train a day, composed of ten 30-ton freight cars. During the period from September to December of that year, the amount of coke sold to the outside reached 30,000 to 40,000 tons and it was mainly sent to the Hsuan-hua Pig-iron Manufacturing Plant. The amount of coke sold to the outside in 1953 was about 100,000 tons and it was reported that coke was shipped to the pig-iron manufacturing plants in HSUAN-HUA and YANG-CH'UAN and also to various mills in T'AI-YUAN. It seems that a certain amount of coke was also shipped to the Shih-ching-shan Iron and Steel Works.

(4) Coke breeze is consumed at this steel works as fuel for sintering fine ore.

d. Quality of coke -- see Table No 10-11.

(1) After the Chinese Communists took control, both composition and strength of coke have been greatly improved. The ash content has been particularly low and in 1953, the ash content of coke used for blast furnaces was less than 13 per cent. Owing to high-temperature distillation, the coke strength has been raised and its hardness has been somewhat increased. However, the porosity has been somewhat lessened. The size of coke produced is generally 100 to 150 millimeters.

(2) Poor quality coke which was produced during the Japanese era and the Chinese Nationalist era was dumped in piles about four to five meters high within this steel works and until the end of the first quarter of 1953 it was distributed to the employees as domestic fuel.

e. Percentage of products meeting specification

(1) Prior to Chinese Communist control, there was a considerable amount of lump coke which was rejected as fuel for blast furnaces. The reason why the pig iron output of blast furnaces was not standardized at that time and was generally poor is believed to be largely because of the fact that poor quality coke was used.

(2) Since the specifications of coke were strictly adhered to since Chinese Communist control, the percentage of rejects was greatly lowered. All the products of ovens which produced rejected coke are discarded and are not used as fuel for blast furnaces.

f. Coking time (from charging to drawing)

Prior to Chinese Communist control, the coking time required 24 hours. However, since Chinese Communist control, it has been considerably shortened.

(1) In 1952 (actual result)

(a) Coke oven No 1: 17 hours

(b) Coke oven No 2: 15 to 16 hours

(2) In 1953 (planned)

(a) Coke oven No 1: 16 hours

(b) Coke oven No 2: 15 hours

g. Operating rate

Prior to Chinese Communist control, there were three inefficient ovens but there were no inefficient ovens under Chinese Communist control. The planned operation rate for 1953 was 99 per cent for coke oven No 1 and 99.2 per cent for coke oven No 2.

h. Percentage of coke breeze

The planned percentage of coke breeze for 1953 was five per cent for coke oven No 1 and eight per cent for coke oven No 2.

i. Recovery rate (yield rate)

In the 1953 plan, the recovery rate of coke for the amount of coal charged was 80 per cent for coke oven No 1 and 77 per cent for coke oven No 2. Compared to the 66.5 per cent recovery rate (lump coke) prior to Chinese Communist control, the recovery rate for 1953 is a considerable improvement even when the percentage of coke breeze is subtracted.

13. Repair of coke ovens

a. Life span of a coke oven

The life span of a coke oven varies according to its type. Under normal operation (about 90 per cent of the rated capacity) it is possible for a coke oven to be used for 15 years. Coke oven No 1 was initially fired in July 1940 and had been in use for 15 years by mid-1955. By spring 1953, this oven had considerably deteriorated.

b. Repair of cold coke oven

Repairs after ovens have cooled differ with the degree of damages. Past repairs made at this steel works are as follows:

(1) At the end of World War II

Since shipment of coal was cut off at the end of World War II, the ovens were deliberately cooled. However, the number of cracks on the walls caused by contraction was very limited. Three ovens were operating poorly even before the ovens were cooled; therefore, it was decided that they would be repaired on this occasion. The time required for coating all the furnace walls and relining the bricks of the three ovens (carbonization chambers and regenerators) was one month during which period a total of about 450 workers was used.

(2) At the time of seizure by the Chinese Communists

Since this plant was located directly in the center of the fighting during the Chinese civil war, and also because of the fleeing of the employees, the plant was forced to shut down operation, which resulted in the rapid cooling of the ovens. However, since rehabilitation work was carried out even before the ovens were completely cooled, there were no serious damages.

Note: The three poorly operating ovens, which existed from the Japanese era, initially produced a larger amount of coke breeze due to the poor quality coal used as raw material. Consequently, the coke could not be withdrawn by means of a coke pusher. A coke pusher was used after about 1.5 to two meters of coke were dug out from both sides of the ovens by manpower (known as "oven digging"). Since this was frequently repeated, the oven walls on both sides became cool and created cracks. The central portion became concave because of the great resistance confronted while coke was being withdrawn by means of a coke pusher. This also caused ovens on both sides to bend. An extreme case of the above case is shown on Chart No 10-11.

D. Chemical Plant

1. Affiliation and number of plants

a. Affiliation

The Chemical Plant is affiliated with the Coking Department of the Production Office of the T'ai-yuan Iron and Steel Works

b. Number of plants: four (end of the first quarter of 1953)

(1) Suction plant

(2) Ammonium sulphate plant

(3) Tar plant (includes extraction of naphthalene)

(4) Benzol plant

These four plants are set up in such a way that an integrated chemical synthesis operation can be carried out.

2. Operations

a. Suction plant

It draws the gas from the coke ovens and extracts water and tar contents from the gas. Then after the by-products are recovered, the gas is distributed to the coke ovens, rolling mills, and boilers for heating purposes.

b. Ammonium sulphate plant

The water content which was obtained by cooling the gas from the coke ovens is fractionated and made into condensed liquid-ammonia which is passed through chemical reactions and made into ammonium sulphate.

c. Tar plant

Tar is distilled and separated into liquid-ammonia, light oil, middle oil, heavy oil, crude naphthalene, crude anthracene, pitch and others.

d. Benzol plant

Benzol is drawn out from the gas in light oil. This light oil is then fractionally distilled to yield benzol.

3. Equipment

a. Disposition of plant facilities -- see Chart No 10-6.

b. Equipment at the suction plant -- see Table No 10-12.

c. Equipment at the ammonium sulphate plant -- see Table No 10-13.

d. Equipment at the tar plant -- see Table No 10-14.

e. Equipment at the benzol plant -- see Table No 10-15.

4. Improvements and increase in facilities

a. Gas suction and gas scrubbing equipment for coke oven No 2

The gas suction and gas scrubbing equipment are of the same design as those for coke oven No 1. One set of these facilities was additionally installed. Of these facilities, the 2.5-inch gas pipe was replaced by a three-inch pipe to increase the cooling volume of the gas coolers. At the same time, large pumps for gas suction were installed in order to supply gas to the rolling mill.

The 250-horsepower motors for the gas suction machines were unused motors which were brought from the Pen-ch'i-hu Coal and Iron Company during the Japanese era. Along with this transfer of the motors, the 41-horsepower motor of the gas suction machine for coke oven No 1 was replaced by a 150-horsepower motor. Consideration is being given for increasing the capacity of other facilities in comparison with the capacity of auxiliary facilities for coke oven No 1 and to cope with the demand for higher production.

b. By-products plant

Since September 1952, the by-products from coke oven No 2 were tentatively sent and processed at the existing by-products plant. However, owing to its limited capacity, buildings were under construction in spring 1953 for the purpose of additionally installing eight crystallization tanks at the tar plant. Also, two or three additional oil coolers (spray system) were then under construction at the benzol plant.

5. Coordination of facilities

The by-products processing facilities under Japanese management were designed to cope with an output of 70,000 tons of pig iron a year and 360 tons of raw materials charged into coke ovens during the period of 24 hours. On the assumption that, for the amount of coal charged, the standard production rate of ammonium sulphate is one per cent, tar is five per cent, benzol is 0.7 per cent and crude naphthalene is six per cent of the production rate of tar, (refined products are 65 per cent of crude products), it seems that the facilities were capable of a certain amount of surplus production.

However, following the additional installation of coke oven No 2 in September 1952, the facilities were no longer capable of processing all the by-products and moreover existing facilities in general were in a deteriorated condition. Consequently, the lack of balance in the facilities became conspicuous. To compensate for this shortcoming, an expansion of the by-products plant was planned in spring 1953. However, the execution of this plan was then expected to take place during the period of the second basic construction phase (the second half of the First Five-Year Plan) of this iron and steel works.

6. Operational methods

a. Suction plant -- see Chart No 10-9.

(1) Condensation and separation of water and tar

The gas produced in the coke ovens has a considerably high temperature and also contains a large amount of water and tar. This gas is accumulated in the dry main, cooled by liquid ammonia, and then indirectly cooled by gas coolers after passing through the suction main. During this process, liquids are removed by means of seal pots and the gas is condensed and separated by means of coolers and other apparatus.

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(2) Secondary recovery of tar

The gas, which was condensed and separated, is cooled by the coolers. It is passed through a tar extractor by means of a gas exhauster and is again sent to a tar extractor where the remaining tar is removed.

(3) Recovery of ammonia and benzol

The gas which has been passed through the tar extractor twice is sent to the ammonia scrubbers where the ammonia content is recovered and then sent to the benzol scrubbers where the benzol content is recovered.

(4) Regeneration of the gas for heating purposes

After recovering all the by-products, most of the gas is used as heating gas for coke ovens, for heating furnaces of the rolling mills, for tar distillation, and for chemical analysis.

(5) Recirculation of liquid ammonia of the dry main

The liquid ammonia from the dry main is passed to the separating tank where it is separated from the tar. It is then sent back to the dry main by pumps and reused.

(6) Recovered water of the gas coolers

Water which was used in the gas coolers is sprayed and cooled at the cooling tower and recirculated into the gas coolers.

b. Ammonium sulphate plant -- see Chart No 10-12.

(1) Processing method

This is the only plant utilizing the "gypsum method" in the Orient. The semidirect method has been adopted in JAPAN and the sulphurous acid method is used at the plant of the former Manchuria Chemical Co, Ltd in DAIREN. The method now adopted in JAPAN should be regarded as the saturation method and must use sulphuric acid.

It is reported that in SHANSI Province there is a comparatively limited amount of sulphuric acid resources (although surveys on natural resources are still inadequate) but there is an inexhaustible deposit of gypsum, which can be used as substitute for sulphuric acid. Therefore, it is conceivable that this plant adopted the gypsum method as in the case of GERMANY.

The finished product based on this method is definitely neutral. Therefore, there is no necessity for neutralization and its purity is more than 99 per cent. Compared with the saturation method, the facilities used in this method seem to be fairly complicated but the containers do not have to be made entirely acid proof.

(2) Condensation and separation by coolers

The gas produced in coke ovens is passed through the suction main to the gas coolers. When the temperature of the gas is reduced to about 35 degrees centigrade, most of the tar and water contained in the gas are condensed. On this occasion, the water absorbs about 30 per cent of the ammonia in the gas and thereby forms liquid ammonia.

The condensed tar and liquid ammonia are separated by specific gravity (tar, 1.2; liquid ammonia, 1.0). Subsequently, tar is sent to the tar plant and liquid ammonia is distilled by ammonia stills at the ammonium sulphate plant.

(3) Recovery by ammonia scrubbers

After recovering the tar and liquid ammonia by means of coolers, the gas is passed to the gas exhauster, then to the tar extractor and finally to the cooler. Here, the remaining tar which was not extracted during the initial process through the primary coolers and the tar extractor installed in front of the gas exhauster is removed. Subsequently, the gas is led to the ammonia scrubbers where the gas is scrubbed through the cold water sprinkling system. Thus, the remaining ammonia in the gas is recovered and naphthalene is also removed at the same time.

(4) Formation of concentrated liquid ammonia

The above liquid ammonia merely contains about 0.5 per cent of ammonia. Therefore, a limited amount of this liquid ammonia is charged into the still and the still temperature is maintained at 100 degrees Centigrade by forcing steam into the still from its bottom. (Prior to Chinese Communist control, both liquid lime and steam were used). The water is removed and concentrated liquid ammonia is formed. The concentration of liquid ammonia is considered most suitable when it is at 10 to 12 per cent for the purpose of the following processing operation.

(5) Reaction by reactor

The reactor is a container which is equipped with an agitator inside and which has a conical top and a cylindrical bottom. The upper portion consists of two layers. The concentrated liquid ammonia is charged into this reactor and a reaction is obtained by forcing carbon dioxide into the reactor from its bottom and charging powdered gypsum from the top while the concentrated liquid ammonia is being stirred. As the reaction progresses, the temperature rises somewhat, therefore the reactor must be cooled and regulated to maintain a constant temperature of 45 to 50 degrees Centigrade.

It is believed that during this process, ammonium sulphate is not formulated directly, but that ammonium carbonate is first formed from which ammonium sulphate is then formulated. Expressed in equation form, the reaction is believed to be as follows:

$$2NH_3 + H_2O + CO_2 \longrightarrow (NH_4)_2\,CO_3$$

$$(NH_4)_2CO_3 + CaSO_4 \rightarrow (CN_4)_2SO_4 + CaCO_3$$

(6) Separation by filter

In this reaction, the degree of solubility of ammonium sulphate is high but the degree of solubility of calcium carbonate is extremely low. Consequently, the ammonium sulphate remains liquefied while calcium carbonate forms a precipitate. This mixture is passed through a vacuum filter and the calcium carbonate precipitate is filtered out from the ammonium sulphate solution.

(7) Crystallization of ammonium sulphate

The filtered ammonium sulphate solution is sent through the preheater to the vacuum still where the ammonium sulphate is crystallized. The crystalline ammonium sulphate is accumulated in the ammonium sulphate collector, then placed in the centrifugal separator which completely separates the crystals from the basic liquid. Crystals of ammonium sulphate are dried in the drying room.

c. Tar plant -- see Chart No 10-13.

(1) Preheating by heat exchanger

The tar withdrawn from tar tanks is first sent to the primary heat exchanger. A hose tube is installed in the tank of the heat exchanger and warm distilled gas from the intermittent

stills flows through this hose tube. The cold tar which is to be distilled in the following process flows on the outside of the hose tube and is thus preheated. Since the distilled gas from the stills has been heated to a temperature of 100 to 300 degrees Centigrade, the tar is automatically heated to over 100 degrees Centigrade. Consequently, the liquid ammonia and a part of the light oil is evaporated and anhydrous tar is formed.

(2) Distillation method and temperature

The anhydrous tar is charged into the intermittent still which is gas-heated (hand-firing of coal is also possible) from the bottom. The tar is gradually heated to remove its oil content, leaving only pitch at the end. In the latter phase of distillation, steam is blown into the still to aid the distillation. The distillation temperature is as follows:

(a) Liquid ammonia: up to 100 degrees Centigrade

(b) Light oil: 100 to 170 degrees Centigrade

(c) Middle oil: 170 to 270 degrees Centigrade

(d) Heavy oil: over 270 degrees Centigrade

It takes about 30 hours to distill a 20-ton still. Consequently, the daily distillation output of two intermittent stills is 30 tons.

(3) Regulation of distillation period

The period of distillation is regulated according to the melting point of pitch. In the event that soft pitch is desired, distillation is shortened to leave a certain amount of oil content in the pitch. At this plant, there is a very limited demand for soft pitch and hard pitch is mainly produced to increase the output of oil (creosote oil) used for recovering benzol.

(4) Pitch production

After distillation, the remaining pitch is placed in the pitch cooler. When it has cooled somewhat, it is drawn into the pitch bay and naturally cooled and hardened. When it is to be sold to other enterprises, it is dug and loaded onto freight cars.

(5) Extraction of middle oil and heavy oil

The light oil, middle oil, and heavy oil from stills are somewhat cooled by the secondary

heat exchanger and again cooled by coolers. These oils are liquefied, accumulated in receivers, and sent to their respective crystallization tanks. These oils, are naturally cooled for several days at their respective crystallization tanks. Naphthalene is extracted from the middle oil and crystallized anthracene is extracted from the heavy oil. The oil content is sent back to their respective tanks.

In separating crystals, the simple sublimation oven is used and the crystals are indirectly sublimated (a phenomenon to directly evaporate solid elements) by steam. Following separation of crystals, the heavy oil is further processed by the filter press to remove the residue anthracene and is then sent to tanks.

(6) Separation of liquid ammonia and light oil

The liquid ammonia and light oil, which were evaporated in the stills and the primary heat exchanger, are cooled and separated by their own separators.

d. Benzol plant -- see Chart No 10-13.

(1) Recovery method

In recovering benzol, there are the "gas cooling method", "absorption method by creosote oil", and "absorption method". At this plant, the oil scrubbing method with creosote oil is adopted. That is, the gas which had passed through the ammonia scrubbers is sent to the benzol scrubbers and 90 per cent of the benzol in the gas is absorbed through the creosote-oil spray system. This oil which is called rich oil contains two to five per cent benzol, therefore it is distilled to extract the benzol.

(2) Extraction of crude benzol

The rich oil is first heated at the heat exchanger by the waste oil returned from the light-oil still. Then, it is led to the preheater, indirectly heated to over 125 degrees Centigrade by steam, and led to the light-oil still. In the light-oil still, if the temperature of waste oil at its outlet is maintained at more than 105 degrees Centigrade, the benzol evaporates from the top of the still together with the steam. The compound of benzol and water which had evaporated from the light-oil still is passed to the dephlegmeter where the oil and water are separated. Subsequently, it is sent to the semiprocessing still

and further distilled to extract the crude benzol. In the semiprocessing still, it is indirectly distilled by steam to a temperature of about 140 degrees Centigrade and the formulated distillate is tentatively sent through the cooler to the tank. This crude benzol is a compound of benzene, toluene, and xylol and contains carbon disulphide, unsaturated hydrocarbon of pyridine and other chemical compounds.

(3) Extraction of refined benzol

In purifying crude benzol, the common method was to remove the impurities by washing the crude benzol with concentrated sulphuric acid and sodium hydroxide. This plant is equipped with facilities to carry out the above process but the facilities have not been used to this date from the Japanese era. This plant is merely engaged in producing motor benzol which is used as a substitute fuel. Operation of the refining still is the same as that of the semiprocessing still. However, before the distillation is completed, steam is directly blown into the still merely to aid the distillation.

(4) Extraction of toluene

Fractional distillation of toluene was once commenced in the latter phase of the Japanese era because of the need for TNT. However, pure toluene could not be recovered and only crude toluene of about 70 per cent purity was extracted. Following Chinese Communist control, fractional distillation of toluene has not been conducted.

(5) Disposition of ramaining oil

The remaining oil is mixed with the residue of the semiprocessing still and sent to the naphthalene crystallization tank. Following separation of crystals, it is either mixed with the creosote oil or shipped to the rubber plant as solvent oil.

(6) Regeneration of waste creosote oil

The waste oil which is drained from the bottom of the light-oil still is creosote oil which does not contain any water or benzol. It is sent through the heat exchanger to the oil cooler. After the temperature of the waste oil is reduced to about 25 degrees Centigrade it is returned to the benzol scrubbers and again used for absorbing benzol. Thus, the creosote oil is repeatedly used but it eventually becomes viscous and loses its benzol absorption power. Therefore, it is either redistilled or used as an antiseptic.

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7. Raw materials

a. Volume of gas produced by coke ovens

The volume of gas produced is uncertain since there is no gas flow meter. However, considering the volatile content of coal, it is believed that about 260 to 280 cubic meters of gas is produced for each ton of coal charged. Therefore, it is conceivable that the volume of gas produced in 1953 reached about 106,600,000 to 114,800,000 cubic meters.

Note: According to the 1953 plan, the amount of clean coal to be charged was 410,000 tons.

b. Supply and demand of gas

All the coke-oven gas is sent to the by-products plant. However, only 12 or 13 per cent of this gas is used as by-products raw material. The volume of escaped gas is unknown. After the by-products were recovered the gas was distributed in the following proportions in 1953.

(1) Heating fuel of coke ovens: about 55 per cent

(2) Heating furnaces at the rolling mill:

(3) Tar stills at the by-products plant:

(4) Boilers:

(5) Assay room:

$\left.\right\}$ about 45 per cent

However, gas distribution to the rolling mill was often cut off because of the insufficient capacity of the gas exhauster.

8. Production

a. Annual output by items -- see Table No 10-16.

Production of carbolic acid was commenced with makeshift facilities as a countermeasure for the so-called bacteriological warfare in spring 1952. Consequently, it is not proper to estimate the subsequent annual output of carbolic acid based on its production in 1952. In addition, there was a plan to produce carbon black but it was never carried out.

b. Destination and usage of by-products

Of the by-products, nearly all of the ammonium sulphate, pitch, and crude naphthalene (including industrial naphthalene), 80 to 90 per cent of benzol, and 10 to 15 per cent of tar are sold to the outside. Ten to twenty per cent of benzol (substitute automobile fuel), 85 to 90 per cent of tar (distilled to extract creosote oil used for recovering benzol) and crude anthracene (fuel) are domestically consumed.

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Note: Light, middle, and heavy oils are mixed and used as creosote oil for recovering benzol. Crude anthracene is used as fuel for gas producers at the open-hearth furnace plant and converters.

c. Distillation ratio

The distillation ratio at the tar plant is as follows:

(1) Light, middle, and heavy oils: 23 per cent

(2) Crude naphthalene: 6 per cent

(3) Crude anthracene: 2 per cent

(4) Pitch (soft and hard): 65 per cent

(5) Loss: 4 per cent

Note: Figures in Table No 10-16 are based on this ratio.

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III. Pig-iron Manufacturing Department

A. Affiliation and Number of Plants

1. Affiliation

Pig-iron Manufacturing Department of the Production Office, T'ai-yuan Iron and Steel Works

It is under the supervision of the assistant superintendent for production.

2. Number of plants

There was one blast furnace plant which was divided into the following three small plants (shops).

a. Blast Furnace No 1 Plant

b. Blast Furnace No 2 Plant

c. Raw Material Plant

B. History

1. In 1934, YEN Hsi-shan contemplated the construction of both the pig-iron manufacturing and the coking departments on a priority basis when the T'ai-yuan Steel Mill, the predecessor of the present works, was established. When the Japanese troops occupied the mill in November 1937, ninety per cent of blast furnace No 1 (rated capacity, 40 tons) and about 60 to 70 per cent of blast furnace No 2 (rated capacity, 120 tons) were already completed.

2. From January 1938, the construction of plants was resumed by Japanese technicians under the supervision of the Japanese Army. In November 1939, blast furnace No 1 was completed and fired, and in November 1940, blast furnace No 2 was completed and fired. Thus the pig-iron manufacturing department commenced full operation.

3. As the war progressed, the demands for steel increased. In order to meet this demand the construction of blast furnaces (small furnaces with rated capacity, 40 tons each) No 3 and No 4 started from mid-1943 based on the plan of the Japanese government, and their completion and initial firing were realized in October 1943. Normal production, however, could not be attained because of the worsening conditions in local peace and order and the intensification of bombing raids by the US Air Force. Since then, for a period of a little over a year, only 5,163 tons of pig-iron were produced. Two small blast furnaces were destroyed in the bombing raid in late 1944. At that time, blast furnaces No 1 and No 2 did not suffer immediate damages, but due to difficulties in obtaining raw materials and shortages of workers, blast furnace No 1 was forced to suspend operation in spring 1945.

4. Before the end of the war, the pig-iron manufacturing department was at its peak in 1942, and the total pig-iron output during that year was 44,201 tons. At that time, blast furnace No 1 mainly produced foundry pig iron, and blast furnace No 2 produced open-hearth pig iron.

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5. After the end of the war, the seizure of the plants by the Chinese Nationalist Government was carried out fairly smoothly; therefore, there was no disruption in the operation of blast furnace No 2. Blast furnace No 2 resumed operation in spring 1946, and for awhile, it was operated satisfactorily, but with the subsequent intensification of the Chinese civil war, shortages in raw materials occurred. After the wheat harvesting operations in spring 1948, pressure by Chinese Communist troops became intense. In autumn 1948, blast furnace No 2 was finally forced to suspend operation with the loss of the Fu-chia-t'an Coal Mine. Only blast furnace No 1 was barely able to maintain its operation.

6. Under Chinese Nationalist control after the end of the war, the actual output of pig iron was comparable to about 60 per cent of that during Japanese control. During this period, steel plates, pipes, and furnace wall bricks of the two small blast furnaces and their attached hot-blast stoves which were damaged by bombing raids before the war's end were all removed by the Chinese Nationalist authorities because of the shortages of materials and used for different purposes, leaving no trace of these facilities behind.

7. On 19 April 49, the plant was taken over by the Chinese Communist troops. There was no damage to the plant facilities during the civil war. There was no let up in production even for one day after the plant was seized. Blast furnace No 2 resumed operation in autumn 1949. Blast furnace No 1 resumed operation for the third time in 1950.

C. Facilities

1. Principal facilities

a. Layout of plant facilities -- see Chart No 10-14.

b. Blast furnace facilities -- see Chart No 10-17.

c. Hoisting device for blast furnace -- see Chart No 10-18.

d. Hot-blast stove -- see Chart No 10-19.

e. Blower -- see Chart No 10-20.

f. Gas-cleaning apparatus

The Theisen disintegrater-type gas scrubber equipped with combined gas purification apparatus was installed to absorb dust from blast-furnace gas.

(1) Type: Theisen disintegrator-type

(2) Gas purification capacity: 20,000 cubic meters an hour

(3) Amount of water used: unknown

(4) Amount of electric power used: 150 horsepower

(5) Dust removal ratio: 0.5 gram per cubic meter

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2. Accessory equipment

a. Ore storage yard

This is an open-air storage yard with an area of 200 meters by 300 meters

b. Two crushers

For the purpose of spalling iron ore and limestone, two new crushers were installed. Each crusher was capable of spalling 25 tons an hour. These crushers were capable of spalling 375,000 tons of ore which is sufficient for the production of 150,000 tons of pig iron a year.

$$150{,}000 \text{ tons} \times (1.76 + 0.74) = 375{,}000 \text{ tons}$$

Pig-iron output	Iron ore	Limestone	Amount of ore needed to be spalled

However, the actual working hours of the crushers are reduced somewhat because the fine ore requires no crushing. The maximum size of the crushed ore is about 90 millimeters.

Note: Before this equipment was installed, the ore was crushed by hand and transported on dollies.

c. Belt conveyor

The belt conveyor was established in 1951 to transport raw materials from the ore storage yard to the ore bins.

d. Ore-screening apparatus

It was installed in 1951 to screen crushed ore.

e. Ore-storage bin

It was installed in 1951 as an ore-charging apparatus. It was equipped with a hopper to supply ore to scale cars.

f. Coke bin

It was newly installed in 1952 as a coke supply facility and is equipped with a hopper to supply coke to scale cars.

g. Scale car

It was made in GERMANY and can weigh up to about four tons.

h. Roasting furnace

There were four simple clamp-type roasting furnaces. Each furnace was capable of roasting 10 to 20 tons of iron ore at a time.

i. Sintering furnace

There were two 4-ton and two 6-ton sintering furnaces. The daily productive capacity was about 50 tons.

j. Ladles for hot-metal car

There were two ladles. The capacity was 25 tons each.

3. Removal and destruction of equipment

During the second bombing raid on T'AI-YUAN by the US Air Force stationed in CHINA in late 1944, eight 250-kg bombs scored near hits and damaged the small blast furnaces No 3 and No 4. Therefore, the mill was forced to abandon these furnaces. After the end of the war, since the attached equipment was removed and diverted for other uses during both the Chinese Nationalist era and the Chinese Communist era, their original form was practically gone. The columns (six) of the blast furnaces were used as supports for the ore belt conveyor which was installed in late 1951 and the iron plates of the hot-blast stoves were diverted for use as building materials.

4. Increase and improvement of equipment

a. Improvement of raw material facilities

In the past, the ore was crushed by hand and transported on dollies. However, the complete mechanization of raw material facilities was realized in 1951; such as the installation of belt conveyors, crushers, screening apparatuses and ore bins. Since the crushed ore is also sintered and charged into the furnace, the screen is standardized at 50 mm. In addition, the information concerning the mechanization of the coke supplying equipment is as previously mentioned.

b. Enlargement of furnace capacity

After the Chinese Communists took control, the thickness of the brick wall of the furnace was reduced to increase its working volume. The increase in working volume of the furnace due to remodelling is shown on Table No 10-17. Along with this remodelling, the capacity of the hot-well section was also increased conspicuously. The working volume of blast furnace No 2 is also being enlarged under a similar method, but it was impossible to ascertain the true figure of the enlarged working volume of the furnace. The second repair work on blast furnace No 2 since the Chinese Communists took control was expected to be conducted after May 1953. However, during the course of this repair work, there were no plans to increase the working volume furnace. It can thus be construed that the inner capacity had already been enlarged to the limit during the initial repair of the said blast furnace.

c. Enlargement of the tuyere

After the Chinese Communists came into control, it became possible to increase the blast volume by enlarging the diameter of the tuyere.

d. Increase in blower capacity

After the Chinese Communists came into control, the pig-iron output of blast furnace No 2 was increased by 20 to 30 per cent with the use of blower No 4 (1,500 hp). Blower No 3 (800 hp) was used in place of blower No 4 while the latter underwent routine repairs (for six days a month). During this period, the daily output of pig iron decreased from an average of 300 tons (when blower No 4 is used) to about 50 to 80 tons.

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5. Defects in layout of equipment

The site area of the blast furnace plant is very limited, therefore there is no room for expansion. The power plant is located on the western side, and the area to the west of this power plant is an unusable depressed area. The area south of the former site of the small blast furnace is a lowland that cannot be used except as a rubbish dump. There are plants established to the north and east, therefore the only space for additional facilities is limited to the former site of the small blast furnaces and its vicinity.

6. Coordination of equipment capacity in relation to other affiliated departments

a. Coordination with the coke department

(1) In the latter part of the first quarter of 1953, the capacity of the coking equipment was 290,000 tons. Taking the coke ratio of 1.13 as the standard, it is sufficient for the production of 250,000 tons of pig iron. Consequently, the production of 151,250 tons of pig iron planned in 1953, and even the production of 200,000 tons of pig iron planned for the future clearly indicates the relatively low pig iron production capacity.

(2) The coefficient of effective utilization of the working volume of the blast furnaces in the latter part of the first quarter of 1953 was 1.0 to 0.9. In the near future, there is a possibility of improving it to 0.7. In such case, the pig-iron output will reach the 230,000-ton level. At the same time, however, the coke ratio will also be sure to drop so that the imbalance in equipment capacity in relation to the coke department will probably continue for some time.

(3) The pig-iron manufacturing goal of the iron and steel works in the latter part of the First Five-Year Plan was said to be 300,000 tons. Even on the part of the coke department, the new construction of coke oven No 3 is said to have been contemplated during this period. Therefore, an imbalance in the output of coke and pig iron would probably continue for quite some time. The fact that the plan for the outside sale of coke by this iron and steel works is reported to have permanency can be said to confirm the situation of this period.

b. Coordination with the steel manufacturing department

(1) The steel output of this iron and steel works under the first plan of 1953 was 130,000 tons. This planned amount, however, was a conservative estimate because the expected importation of crane equipment was delayed. It can be

seen definitely that if the crane equipment arrives and the attached facilities are improved, 170,000 tons of steel can be produced. If tappings can be carried out four times a day, it would be possible to produce 185,000 tons of steel in the future with the three existing open-hearth furnaces.

The amount of molten pig iron charged in the latter part of the first quarter of 1953 was 800 kg to each ton of steel produced. If this is considered as the standard, then the amount of molten pig iron needed to make 170,000 tons of steel would be 136,000 tons, and 148,000 tons of molten pig iron would be needed to make 185,000 tons of steel. In both cases, it can be assumed that the steel output is roughly balanced with the planned amount of pig iron output for 1953.

(2) Around April 1953, plans for the construction of an additional two open-hearth furnaces (capacity, 50 tons each) had already been materialized. The realization of this plan increases the steel manufacturing capacity of this works by 70 per cent as compared to the production level of 1953. Therefore, the amount of molten pig iron needed within the iron and steel works would be about 230,000 tons, and including the production amount of foundry pig iron and chilled pig iron, about 300,000 tons of pig iron would be required. Since the above figure matches perfectly with the pig-iron production goal of the works for the latter part of the First Five-Year Plan, it can be said that the production of pig iron and steel was well balanced throughout this period.

Note: 1. The anticipated output of the existing blast furnaces when the effective capacity utilization coefficient is 0.7 can be computed as follows:

	Effective capacity (m^3)		Utilization coefficient (m^3/ton/day)		Calendar days		Rate of operation		Acceptance rate		Annual output (ton)
Blast furnace No 1	158	÷	0.7	x	365	x	0.99	x	0.99	=	approximately 80,300
Blast furnace No 2	292	÷	0.7	x	365	x	0.99	x	1.00	=	approximately 150,800
Total											231,100

2. The basis for calculating the steel manufacturing capacity (170,000 tons) of the existing open-hearth furnaces is as follows:

Steel output each time (ton)		Number of times a day		Calendar days		Rate of operation		Acceptance rate		Number of furnaces		Output (ton)
50	x	$\frac{\text{24 hours}}{\text{6.4 hours}}$	x	365	x	0.85	x	0.98	x	3	=	approximately 170,000

3. The amount of molten pig iron required in the plan for 1953 is as follows:

Planned amount of steel (ton)		Acceptance rate		Amount of molten pig charged per ton of steel output (ton)		Amount of molten pig needed (ton)
130,000	÷	0.98	x	0.8	=	approximately 106,000

4. Computation of foundry pig iron and chilled pig iron output in 1953 is as follows:

Planned amount of pig iron (ton)		Amount of molten pig needed (ton)		Foundry pig iron and chilled pig iron output (ton)
151,250	-	106,000	=	approximately 45,000

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D. Operational Organization of Labor

See Chart No 10-15

E. Operational Method

1. Operational process -- see Chart No 10-16

The operational process shown on Chart No 10-16 was put in force in 1951 after the ore-processing facilities were mechanized. Until then, the ore was crushed and screened by hand and transported on dollies. Even after 1951, the coke-manufacturing process has been gradually improved along with the completion of various facilities. For instance, in regard to the method of conveyance from the coke storage bin to the hoisting apparatus, plans for electrifying the cars was taking shape in spring 1953, but it had not as yet been carried out.

2. Notes on the operational methods

a. Roasting furnace (clamp-burning type) processing

Iron ore produced at WU-AN and LI-KUO is magnetite. Therefore, to simplify the spalling, the lump ores are sorted out at the ore storage yard and roasted in the clamp-burning type roasting furnace. Lump coal is burned on the ground and lumps of ore are piled around it, then coal is piled on this ore. About 10 to 20 tons of ore is roasted in this manner by natural drought.

b. Number of tappings and removal of slag

Each blast furnace is tapped eight times a day. Slag is removed one hour after each tapping.

c. Processing of pig iron

In the case of foundry pig iron, the hot metal is cast in the sand bed in front of the furnace. In the case of open-hearth pig iron, the hot metal is first poured into the ladle (25 tons) and then charged into the open-hearth furnace. A portion of the remaining hot metal is made into molded pig iron and is also used in the open-hearth furnace. The open-hearth pig iron used at this iron and steel works mainly consisted of hot metal and partially of chilled pig iron. During the Japanese era, the usage of hot metal was comparatively limited because work coordination between the blast furnace and the open-hearth furnace was not well maintained owing to production conditions on both sides.

d. Hot-blast stove operation

Normally, three hot-blast stoves are attached to one blast furnace, of which one is used for air-blasting and the other two for heating. Blast-furnace gas is used for as fuel for heating. The hot air regenerated by heating is mixed with cold air and blown into the blast furnace. However, when the air temperature drops to a prescribed temperature, the source is switched over to the next regenerated hot-blast stove. The blasting duration of a hot-blast stove is about two hours.

3. Improvements in operational methods

There is no particularly new operation method, but from the historic development of production, the following points can be pointed out.

a. Strict sizing of ore

To maintain the furnace in good condition, the size of the ore was standardized at 50 millimeters. Neither excessively large nor excessively small ores were charged into the furnace. For this reason, special care was given to the roasting of hard large ore for easy spalling and to the sintering of fine ore before charging. The original blast furnace No 2 and blast furnace No 2 after its first remodelling had a tendency of frequently forming scaffolds, but due to the thorough sizing of ore and an increase in the volume of air blast, it became possible to enforce efficient operation from late 1950.

b. Increase in the volume of air blast

The 800-hp blower for blast furnace No 2 was used until the early part of the Chinese Communist era, but from about 1951, it was replaced by a 1,500-hp blower. As a result, the draft in blast furnace No 2 has become very effective and production has increased by 20 to 30 per cent.

c. Utilization of superior grade ore

Until about 1950, low-grade ore (iron content, 40 per cent) produced in SHENSI Province was used, but after 1951 the amount of pig-iron output has increased considerably with the utilization of rich ore obtained from other provinces. It may safely be said that the increase in production after 1952 is mainly due to this rich ore supply. After spring 1952, a movement for qualitative improvement was begun and a strict demand for standard-size ores was made to the mines, which brought about highly effective results.

d. Improvement in the quality of coke

It is needless to say that the quality of coke has a great effect on the output of pig iron. At this iron and steel works, the ash content of coke is limited at 11 to 12 per cent. Coke having more than 13 per cent ash content is considered below standard and is prohibited from being used in the charge. The size and structural strength of the coke are also clearly specified and the use of coke not meeting these specifications is not permitted.

Note: 1. It is common knowledge that the increase of one per cent in ash content in coke increases the coke consumption by two per cent in the blast furnace and decreases the pig-iron output by three per cent.

2. The ash content of coke during the Japanese era was more than 17 per cent.

3. Since Chinese Communist control, coke was expended rather wastefully in an attempt to increase production and rationalization in heat control was inadequate.

e. Measures taken to prevent scaffolding of charges

When scaffolding of charges occurred in the blast furnaces, moderate measures were taken during the Japanese era, but under Chinese Communist management, dynamite was used under the guidance of Soviet specialists to facilitate the dropping of materials within the furnace.

f. Importance of slag component

During each inspection tour, the percentage of slag is the chief concern of the Soviet technicians. The above is believed to indicate that they are paying close attention to the charging of raw materials for the purpose of regulating furnace conditions and to the ensuring of the quality of the pig iron produced.

g. The introduction of Soviet techniques

Soviet techniques were fully adopted after 1952. When Soviet specialists came to inspect the plant in autumn 1949, they pointed out the fact that blast furnace No 2 must produce 300 tons of pig iron. At that time, only 120 tons of pig iron was being produced, by this furnace and the plant technicians were very much surprised, to say the least, at such an impossible suggestion. However, the effective working volume of the said furnace was 292 cubic meters and in late 1952, 290 to 320 tons of pig iron were produced daily. Therefore, it has been proven that the output of 300 tons was nothing to be so amazed about.

Friction arose at times between the Soviet technicians and the Japanese technicians because of divergent technical views. For instance, in late 1951, the scaffolding of charge occurred twice in blast furnace No 2. In regard to this instance, there was a difference of opinion between the Soviet specialists who came from PEKING and the detained Japanese technicians, and sharp disagreements arose. The Soviet specialists severely criticized the Japanese pig-iron manufacturing technique as belonging to the eighteenth century, but in the end the Japanese views were accepted and the furnace was repaired. The Chinese Communist authorities were highly concerned over this incident, and after late 1951, Japanese technicians were transferred to the basic construction department or to other factories which were backward in technique. The above is believed to be the step taken before the over all introduction of Soviet techniques after 1952.

F. Raw Materials

1. Sources of various raw materials

a. Iron ore

(1) During Japanese control

Iron ore used during the Japanese era was obtained from SHANSI Province. The principal ores (all poor ore) were as follows:

(a)	Ting-hsiang product (TING-HSIANG Hsien, CHIANG-TS'UN /38° 31'N 113°02'E/)	--- Iron content, 40 to 47 per cent	--- micaceous hematite; contains large amount of silicon dioxide	
(b)	Tung-shan product (The east suburbs of T'AI-YUAN)	--- Iron content, 40 to 47 per cent	Contain 7 to 10 per cent Manganese	Since it belongs to the Shansi pocket deposits, mechanized mining is difficult
(c)	Hsi-shan product (The west suburbs of T'AI-YUAN)	--- Iron content, 40 to 47 per cent		
(d)	Shou-yang product	--- Iron content, 40 to 47 per cent		
(e)	Chieh-hsiu product	-- Iron content, 40 to 47 per cent		
(f)	Ning-wu product	--- Iron content, 40 to 47 per cent		

(2) During Chinese Nationalist control

The iron ore used during Chinese Nationalist control was much the same as that used during Japanese control, but due to the state of peace and order in the district concerned, ore was obtained only from TING-HSIANG, TUNG-SHAN, HSI-SHAN, and SHOU-YANG.

(3) During Chinese Communist control

At the beginning, iron ore produced in SHANSI Province was used as in the past, but due to the poor grade and limited output of this ore, the supply source was gradually shifted to the rich ore found in other provinces. In other words, the above change came about because demands created by the sharp increase in pig iron output from late 1950 through 1952 could not be met.

In regard to iron ore produced in other provinces, the Lung-yen and Wu-an ores were first obtained in late 1950 and used together with several varieties of iron ore produced within the province. In early 1952, however, the Lung-yen product (hematite) was mainly used together with the ore produced at WU-AN (magnetite), LI-KUO (magnetite), and TUNG-SHAN (iron ore found in SHANSI Province). Under the 1953 plan, the supply of raw material depended almost entirely on ores from other provinces. Under the initial phase of this plan, the entire amount was supposed to come from LUNG-YEN, WU-AN, and LI-KUO, but later from the standpoint of regulating the demand and supply throughout the country, the plan was revised so that iron ore produced within the province would be used at the same time, although the amount was very limited.

In this case, Tung-shan ore seems to be the only locally-produced ore that can be utilized. The said ore was mined by hand at the beginning of 1952, and the daily output was about 100 tons. Horse carts were used to transport the ore from the mine.

At one time, iron ore produced at TING-HSIANG in SHANSI Province was widely used. However, since the ore contained mica, it flattened out when crushed and lowered the pig-iron production efficiency by cutting down the draft within the furnace. In addition, due to some errors in digging, the redevelopment plan which was expected to be carried out during 1950 and 1951 also was abandoned in the midst of operations.

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The amount of ore supplied by LUNG-YEN had already reached one hundred and several ten thousand tons in 1952, and this iron and steel works is the largest consumer of this ore. The proposed purchasing amount of iron ore in 1953 is shown on Table No 10-21.

b. Coke

This works has attained full self-sufficiency by using the coke manufactured in its own coke plant. At the beginning of Chinese Communist control, a partial supply of heap carbonized coke was received from CHING-HSING and LU-AN, but it was not long before this purchase was halted.

c. Recovered pig iron

Rejected pig iron is at times recharged into the blast furnace as recovered pig iron, but since the acceptance rate of pig iron is more than 90 per cent, the volume of rejected pig iron is very small.

d. Limestone

Inexhaustible deposits of good quality limestone are found in the Tung-shan and Hsi-shan areas. The source of supply is consistent and has remained unchanged since Japanese control. Limestone produced at HSI-SHAN is transported by rail, whereas limestone from the Tung-shan Mine is transported by horse-drawn wagons.

e. Manganese

(1) During Japanese control

Manganese ore from the Ching-lo Mine (80 km northwest of T'AI-YUAN) was used, and occasionally iron ore (Manganese content, seven to 10 per cent) from the Shou-yang Mine was mixed with the above ore. High-grade ore from INDIA was used before the Pacific War. The manganese ore from the Ching-lo Mine was of good grade and contained more than 40 per cent manganese, but the highest amount of ore dug during one year was about 2,000 tons.

(2) Under Chinese Communist control

Just as was done during the Japanese era, efforts have been made to obtain manganese by using ore produced at the Ching-lo Mine, by mixing this ore with iron ore produced at SHOU-YANG, or by mixing this ore with specular iron manufactured at the Yang-ch'uan Pig-iron Manufacturing Plant or ferromanganese from the Northeast Area. However, from 1952 through 1953, it seems that manganese ore (Manganese content, 32 to 35 per cent) from LO-P'ING in KIANGSI Province was mostly in use. The amount of ore dug at the Ching-lo Mine was about five tons a day in 1950, but this ore appeared to be very near to being exhausted.

f. Fluorite

Prior to Chinese Communist control, fluorite produced at WU-CH'ENG-CHEN (37°25'N 111°26'E) (halfway between FEN-YANG /37°16'N 111°47'E/ and LI-SHIH /37°29'N 111°04'E/) in the southern part of SHANSI Province was initially used, but later it was replaced by fluorite from the Tsingtao district. However, under Chinese Communist control, digging of fluorite from the Wu-ch'eng-chan mine was resumed. Fluorite in this district is a reticulate ore of inferior quality. The mining method was primitive, and the daily output in August 1949 was about 200 tons. Later, it was replaced by fluorite from the Tsingtao district.

2. Volume of various raw materials consumed

a. Consumption rate of raw materials

(1) Iron ore

At the beginning of 1950, the ore ratio was about 2.5, but with subsequent improvement in the ore quality, the ore ratio was expected to be 1.76 under the 1953 plan.

(2) Coke

The coke ratio under the 1953 plan was set at 1.13.

(3) Limestone

In spring 1952, about 500 kilograms of limestone were consumed for each ton of pig iron produced. With the subsequent use of iron ore (magnetite; phosphorus ore) from WU-AN and LI-KUO, the consumption rate of limestone has increased to 800 kilogram for each ton of pig iron produced under the 1953 plan.

b. Volume consumed

(1) Iron ore

The planned consumption volume in 1953 is the sum of the planned purchase amount of ore (264,000 tons) from other provinces shown on Table No 10-21 and the planned consumption volume of the very small amount of provincial ore. However, since an accurate figure of the planned amount of consumption of provincial ore is unknown, it is impossible to point out accurately the proposed gross amount of the said year.

Note: 1. Since it is said that only a relatively small amount of provincial ore is consumed, it would probably be safe to assume that the proposed amount of purchase of ore from other provinces is the planned consumption volume for the said year.

2. With Table No 10-21 as the basis, the average quality of ore from other provinces can be computed as follows:

a. Lung-yen ore 147,000 tons x 0.55 (Fe) = (Fe) 80,850 tons

b. Wu-an ore 74,000 tons x 0.58 (Fe) = (Fe) 42,920 tons

c. Li-kuo ore 43,000 tons x 0.59 (Fe) = (Fe) 25,370 tons

d. Total = (Fe) 149,140 tons

149,140 tons (Fe) ÷ 264,000 tons (Gross tonnage of ore) = about 0.565 (Fe)

On the other hand, the equation will be $\frac{1.00}{1.76} = 0.56$ (Fe) if the ore ratio (1.76) under the 1953 plan is used in the calculation.

It is believed that the resulting difference in the above two calculations may be attributed to the following conditions:

a. Although a very small amount, low-grade provincial ore is included in the planned consumption.

b. About 93 per cent of iron, four per cent of calcium, one per cent of silicon, and some amounts of manganese and other elements are contained in the pig iron. A small quantity of the iron content in the ore is mixed with the slag and dust and is lost.

(2) Coke

If the planned amount of coke consumption for 1953 is calculated from the abovementioned coke ratio, it would be as follows:

151,250 tons	x 1.13	= 171,000 tons
Amount of pig iron accepted	Coke ratio	Amount of coke consumed

Note: Lump coke of less than 13 per cent in ash content is used.

(3) Limestone

When computing from the planned consumption rate (800 kg per ton of pig iron produced will be 0.8) for 1953, the planned amount of consumption of limestone for the same year is as follows:

151,250 tons	x 0.8	= 121,000 tons
Amount of pig iron accepted	Limestone consumption rate	Amount of limestone consumed

(4) Manganese ore

About 30 to 40 kilograms (Consumption rate, 3 to 4 per cent) of manganese ore from LO-P'ING are needed to produce one ton of pig iron. Therefore, the consumption volume of manganese ore during 1953 is estimated to be about 5,000 tons.

3. Charging of raw materials

a. Volume of a single charge -- see Table No 10-22

Volume of a single charge is based on the amount of coke and the amount of iron ore and limestone charged are calculated in proportionate to the amount of coke. The amount charged and the type of raw materials charged depends upon the condition of the furnace.

b. Number of charges per day -- see Table No 10-22

c. Charging order

Iron ore is charged simultaneously with coke and limestone, and according to the condition of furnace, a suitable amount of manganese is charged at the right time.

G. Production

1. Daily output

a. During Japanese control

In the most productive years of 1942 and 1943, the daily output nearly equaled the rated capacity. On the whole, however, the daily output was about 80 to 90 per cent of the rated capacity. In other words, the daily output of blast furnace No 1 was 35 to 40 tons and that of blast furnace No 2 was about 100 tons.

After October 1940 when both blast furnaces No 1 and No 2 were in operation, blast furnace No 1 produced foundry pig iron, and blast furnace No 2 produced open-hearth pig iron. However, in 1945, blast furnace No 1 was blown out, and thereafter, the type of draft pig iron to be produced was decided by the conditions at the time. Under the previously mentioned conditions, small blast furnaces No 3 and No 4 were incapable of much production until they were bombed and blown out in late 1944.

b. During Chinese Nationalist control

Both blast furnaces No 1 and No 2 were in operation, but their daily output seldom exceeded that during Japanese control. Following the "Wheat-harvest Operation" in spring 1948, the Chinese Communist Army intensified its pressure and blast furnace No 2 which was the main production cog had to suspend operation because of the shortages of raw materials in autumn 1948.

c. Under Chinese Communist control

During the period between autumn 1949 and early 1950, blast furnace No 1 produced about 40 tons of pig iron daily and blast furnace No 2 produced about 120 tons of pig iron daily. This amount did not differ much from the output during Japanese management. Scaffolding of charges occurred frequently during the operation of the original and first remodelled blast furnace No 2. Particularly from the early part to the middle of the first remodelled blast furnace No 2 period (Autumn 1949 to May 1953), the efficiency dropped a little due to scaffolding of the charges. In winter 1950, due to damages to the hearth, the furnace was banked for more than a week because of damages to the hearth. However,

from late 1950 through 1952, the production of pig iron became favorable, and thereafter, production started to increase. The changes in daily output during the foregoing period is shown on Table No 10-23.

2. Annual output -- see Table No 10-24

a. During Japanese control

The peak production was in 1942 when 44,201 tons were produced (Blast furnaces No 1 and No 2 were in operation).

b. During Chinese Communist control

Production increased rapidly during the Antirevolutionary Suppression Movement of 1951, and the Three-anti and Five-anti movements of 1952. The total output of blast furnaces No 1 and No 2 in 1952 was more than 130,000 tons. The output consisted mainly of open-hearth pig iron with 30 per cent foundry pig iron.

The planned production for 1953 was 151,250 tons. This amount can be computed as follows:

(1) Blast furnace No 1 (Normal operation)

Effective capacity (m^3)		Utilization coefficient (m^3/ton/day)		Calendar days		Operating rate		Acceptance rate	Annual output (ton)
158	÷	0.9	x	365	x	0.99	x	0.99 =	62,800

(2) Blast furnace No 2 (Blow out was planned)

						Blown out days		Limited production days				
292	÷	1.0	x	(365	-	52	-	30)	x	0.99	x	1.00 = 81,800

				Limited production days		Number of days pig iron not produced				Annual output during non-production period (ton)
292	÷	1.25	x	(30	-	0.5)	x	0.99	x	1.00 = 6,650

3. Distribution of pig iron

a. During Japanese control

Under the integrated process of steel manufacture, the greater part of the pig iron output was supplied to the steel maufacturing department of the works, but a portion was sent to the central plant (the present T'ai-yuan Machinery and Tool Plant).

b. During Chinese Communist control

Considering the actual output of 91,000 tons of steel in 1952, the amount of molten pig sent to the steel manufacturing

department of the works is estimated to be 72,000 tons. Therefore, it can be surmised that approximately 60,000 tons are principally sold outside as chilled pig for open-hearth use and foundry pig iron. Foundry pig iron is sent to the machinery plants in T'AI-YUAN, TIENTSIN, and SHANGHAI. It has been said that the output of foundry pig iron in 1952 is 30 per cent (about 40,000 tons) of the total pig iron output of more than 130,000 tons.

The planned steel output of the works in 1953 is 130,000 tons. The amount of molten pig iron required for this output is estimated to be 106,000 tons (see Note 3 under III, C, 6, b in this chapter). The amount of chilled pig iron that can be sold outside is about 50,000 tons (mostly foundry pig iron). The amount of outside sale is slightly below the figure of the previous year. The planned amount of steel manufacture for 1953 is said to have been reduced by 15,000 tons due to delay in the rebuilding of facilities attached to the open-hearth furnace. Therefore, it can be imagined that the amount of outside sales of pig iron has almost reached the same level as that of 1952.

4. Grade and specifications

After the Chinese Communists took control, the specifications for open-hearth pig iron ranged from No 1 open-hearth pig iron (Silicon content, less than 1.0 per cent; Manganese, 0.8 to 1.5 per cent; Sulphur, less than 0.05 per cent; and Phosphorus, less than 0.5 per cent) to No 3 open-hearth pig iron (Silicon content, 1.25 to 1.50 per cent; other elements are the same as that of No 1 pig iron).

Until spring 1952, the No 2 open-hearth pig iron constituted most of the pig iron produced and there were some that fell short of the specifications. However, from the latter half of 1952, the quality was improved considerably, and the pig iron produced contained 0.7 to 1.2 per cent silicon, about 1.0 per cent manganese, and a very small quantity of sulphur. Thus, No 1 open-hearth pig iron constituted the bulk of the pig-iron output.

The foundry pig iron is also graded from No 1 foundry pig iron to the No 3 foundry pig iron. The No 1 foundry pig iron contains 2.75 to 3.5 per cent silicon, 0.5 to 1.0 per cent manganese, and 0.05 per cent sulphur; whereas the No 3 foundry pig iron contains 1.5 to 2.25 per cent silicon, 0.5 to 1.0 per cent manganese, and 0.06 per cent sulphur.

Based on the silicon content, it can be said that these specifications are intermediate between the specifications used in the UNITED STATES and the USSR. Moreover, for details, refer to a list of temporary specifications of products under XI of this chapter.

5. Percentage of products meeting specifications

The percentage of products meeting specifications in the 1953 plan was as follows:

a. Blast furnace No 1: 99 per cent

b. Blast furnace No 2: 100 per cent

It can be construed that the above figures include the flexibility of applying other standards to those goods of poor quality

which occasionally appear. Blast furnace No 1 produces both foundry and open-hearth pig iron. During its conversion period, however, pig iron that was intermediate in composition between foundry and open-hearth pig iron was at times produced. It is said that even this pig iron can be used in most cases.

6. Effective working volume utilization coefficient of blast furnace.

a. The results of 1952

(1) Blast furnace No 1: about 0.9

(2) Blast furnace No 2: about 1.0

b. The plan for 1953

The Iron and Steel Industry Control Bureau of the Ministry of Heavy Industry has called upon the works to raise the planned effective utilization coefficient of blast furnace No 2 to 0.9. As a result of studies made, the works established the coefficient of blast furnace No 1 at 0.9 and that of blast furnace No 2 at 1.0 by using the results of the preceding year as the basis.

Note: In 1952, the coefficient of the small blast furnace at YANG-CH'UAN was 0.8, and the one at PEN-CH'I, was honored as the national model. However, it was reported that the best monthly average in 1952 was 0.6715 and the best record was 0.613.

7. Operating rate

The operating rate of both blast furnaces No 1 and No 2 as planned for 1953 is 99 per cent. The suspension of operation of one per cent is due to banking of a furnace. The cleaning of blowers is the principal factor for the suspension of operation.

Since blast furnaces No 1 and No 2 are both equipped with reserve blowers, the actual banking of furnace takes only about six to seven hours even during the regular monthly repair (for six days).

However, there is a difference in capacity between the regular blower and the reserve blower. Therefore, the efficiency of pig-iron manufacture decreases while the reserve blower is in use. For instance, in the case of blast furnace No 2 the average pig-iron output was 300 tons a day when the regular blower was used, but when the reserve blower was used, it decreased to 220 to 250 tons a day (in early 1953).

Note: In JAPAN, it seems that the average number of work days for the year is calculated by the following method: the number of days required for major repairs during the life of the furnace is divided by the number of durable years of the furnace to arrive at the average number of days annually required for major repairs. This number is used in calculating the average number of annual work days of the blast furnace. However, in Communist CHINA, the foregoing method was not used. Calculation of the number of annual working days is based on the actual number of working days for each year. Therefore, the total number of days required for

major repairs is subtracted from the number of calendar days of the year in which the repair was carried out or the specified year in which the repair work is expected to be carried out. It is believed that such a method is only logical in the carrying out of a planned economy. See under III, G, 2, b of this chapter for an example of this calculation.

8. Slag

a. Composition

The composition of the slag is about the same as that of the Hsuan-hua Pig-iron Manufacturing Plant mentioned in Chapter Six. Its only characteristic is the large amount of limestone used in the charge. The iron content in the slag is about one per cent of the amount tapped.

b. Disposal

The slag is placed in the slag ladle, and almost all of it is discarded. It was used to fill in depressions and for reclamation purposes. In the early part of 1953, however, a part of it was dissolved in water and made into liquid slag. This liquid slag was sent to the T'ai-yuan Cement Factory and was being tested as a raw material for cement.

9. Blast furnace gas

a. Composition

It is composed of carbon monoxide, carbon dioxide, hydrogen gas, nitrogen gas, methane, and an extremely small amount of iron. It contains a large volume of carbon monoxide.

b. Uses

Since its principal component is carbon monoxide which is poisonous, it cannot be used in homes. After being passed through hurdle-type Teissens gas scrubbers, it is sent to the hot-blast stove and burned. A part of the gas is also used by the boilers attached to the power plant. In the past, large volumes of gas escaped from the throat of the furnace, and it was not used completely. In spring 1953, a plan was set up to use a mixture of coke gas and producer gas in the heating furnace of the rolling mill. However, since blast furnace gas contains only 900 kilocalories per cubic meter as compared to the 4,500 kilocalories per cubic meter of coke gas and the 1,200 kilocalories per cubic meter of producer gas, it cannot be denied that the efficiency of the heat output is low.

10. Life span and repairing of blast furnaces

a. The expected life span of a blast furnace

In early 1953, blast furnace No 1 had undergone its second remodelling and blast furnace No 2, its first remodelling. Throughout Japanese management, the expected life spans of both blast furnaces No 1 and No 2 were about six to eight years. Even during the Chinese Nationalist period after the war's end, the expected life span of blast furnace No 2 was the same as that during the Japanese period.

However, due to shortages of raw materials after the war's end, blast furnace No 1 was not operated regularly with long banking and blown-out periods. Thus, the expected life span of the first remodelled blast furnace No 1 was very short.

After the Chinese Communists took control, the intensive use of blast furnaces and their facilities has become very conspicuous. Since blast furnaces No 1 and No 2 are constantly operated at close to their full capacities, their life-expectancy was limited to only about $3\frac{1}{2}$ years. For instance, the first remodelled blast furnace No 2 was fired in autumn 1949 and it was expected to be blown out for major repairs in May 1953. Also, the second remodelled blast furnace No 1 was fired in 1950 and it was already stated in spring 1953 that this furnace was expected to be blown out for major repair in 1954.

b. Time required for repair of blast furnace

It took six months to repair blast furnace No 2 in 1949. It took four months to repair blast furnace No 1 in 1950.

However, the repair plan for the second remodelled blast furnace No 2 which was expected to be blown out in May 1953 called for 52 days from the blow-out time, through cooling, dismantling, building, drying, and blowing in.

The period is shortened considerably compared to the previous time required for repairs during the Chinese Communist era. On the whole, however, it can be said that this indicates an unusually high efficiency even when compared to the logical time required in repair. Such high efficiency was said to have been attained as a result of the adoption of Soviet furnace-repair method. In JAPAN, due to economic reasons, the repair of furnaces after it is blown out seldom seem to be conducted at such speed. Therefore, accurate data that can be compared to the Chinese Communist method are rarely found. Technically speaking, however, it is said that it normally required 90 to 100 days.

c. Time required in drying the furnace body

The time required to dry the furnace body during the planned repair in 1953 is unknown, but it took three to four weeks when blast furnace No 2 was repaired in 1949.

d. The time required from blow in to initial tapping

It took 24 hours at the time that blast furnace No 2 was fired in 1949, but under the production plan of the said furnace in 1953, it was shortened to 12 hours.

e. Time required from blow in to normal operation

The operation is not normal for about three to four weeks after the blow in. Under the production plan of blast furnace No 2 for 1953, an allowance of a 25 per cent drop in the pig-iron output for the period of one month after the blow in was made. Since this reduced rate is the average value for the entire period, it was less by 50 per cent in the early part of the blow in. After that, it was gradually increased to regain normalcy by the latter part of the period of restriction.

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IV. Steel Manufacturing Department

A. Affiliation and Number of Plants

1. Affiliation

The department is affiliated with the Production Office of the Tai-yuan Iron and Steel Works and is under the jurisdiction of the assistant superintendent for production. The department is divided into the steel manufacturing department and the electric furnace steel department.

2. Number of plants

a. There are the following four small plants (workshops) under the steel manufacturing department.

(1) Open-hearth furnace plant

(2) Ingot casting plant

(3) Gas producer plant

(4) Dolomite plant

b. There are the following two small plants (workshops) under the electric furnace steel department.

(1) Electric furnace plant

(2) Pattern plant

B. History

1. History of the steel manufacturing department

a. The open-hearth furnace plant was designed by a German prior to the Japan-China incident, and part of the work got underway. However, the greater portion of the construction and the installation of machinery were done after the Japanese technicians arrived in January 1938.

b. Difficulties in raw material and transportation were overcome at the time, and the commencement of operations was rushed. As a result, the furnaces were fired and tapped for the first time on 18 Sep 41. Listed below are the principal facilities at the time operations began:

(1) Open-hearth furnace (rated capacity, 30 tons; fixed type): two

(2) Gas producers (13 tons): five

(3) Ingot bed (three plates each): two

c. Of the two open-hearth furnaces only one was worked and operation was confined to about two heats a day. However, in February 1942, steel was tapped three times a day, and the stage for the full scale operation of the two open-hearth furnaces was reached. The peak production year before the end of the war was 1942, in which year the output was approximately 40,000 tons.

d. At first, there were 185 employees (65 Japanese and 120 Chinese), but the number reached 313 (65 Japanese and 248 Chinese) in 1942.

e. Under Chinese Nationalist control following the end of the war, the two existing 30-ton open-hearth furnaces were converted into 40-ton furnaces, and one gas producer (13 tons a day) was newly built. The output, however, never matched that of the Japanese era.

f. In 1952, after the Chinese Communists had taken over control, plans were drawn up to increase the various types of facilities, and the basis for a planned steel output of 130,000 tons for 1953 was set up. During the first half of 1952 the two 40-ton open-hearth furnaces were each converted into 50-ton furnaces. In autumn 1952, one 50-ton open-hearth furnace was added. Also in 1952, two gas producers (30 tons a day each) and one ingot pit were newly built, while three other ingot pits were enlarged. The addition of ladle crane had not been carried out even by spring 1953. This formed the production bottleneck of the department.

2. History of the electric furnace steel department

a. The iron and steel works had no electric furnace facilities during Japanese control before the war's end. The manufacture of electric furnace steel was entirely dependent on the adjacent Yu-ts'ai Machinery and Tool Plant (presently, the T'ai-yuan Machinery and Tool Plant).

b. The works started manufacturing electric furnace steel in 1952. Electric furnaces were brought in from the coastal area in 1952, and in autumn two 3-ton electric furnaces were in operation. Also, efforts were being made to have the two 8-ton electric furnaces that were then being brought in from T'ANG-SHAN in operation by the end of 1953.

c. The transfer of these electric furnaces was at first motivated by the policy for the dispersal of the coastal iron and steel industry to the interior because of the Korean War. Thereafter, from the general standpoint of constructing iron and steel centers in CHINA, the transfer was made under independent plans.

C. Open-hearth Furnace Steel Manufacture

1. Facilities

a. Layout of facilities for open-hearth furnace steel manufacture -- see Chart No 10-17.

b. Size of the plant buildings -- see Table No 10-25

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c. Cross-section of the open-hearth furnace plant buildings -- see Chart No 10-18.

d. Data on open-hearth furnace facilities -- see Table No 10-26

e. Structure of the open-hearth furnace -- see Chart No 10-19

f. Structure of gas and air ports -- see Chart No 10-20

g. Brick-laying prodedure for the regenerator -- see Chart No 10-21

h. Refractory materials used in the open-hearth furnace -- see Table No 10-27

i. Gas producer facilities -- see Table No 10-28

j. Structure of the ladle car -- see Chart No 10-22

k. Structure of the ladle used for molten steel -- see Chart No 10-23

l. Shape of the ingot cases used for rimmed steel -- see Chart No 10-24

2. The removal and destruction of facilities

No facilities have been affected. The US air raid just before the end of the war and the Chinese Nationalist air raid directly following the seizure of this plant by the Chinese Communists inflicted virtually no damage upon the open-hearth furnace plant.

3. Improvement of facilities

The open-hearth furnace facilities were mainly improved since 1952. The main improvements are as shown on Table No 10-30.

Note: Three technicians took part in improving the construction plans. One was a detained Japanese, another was an assistant superintendent of the works, and the third was a Chinese engineer (graduate of the Kuramae Higher Technical School in JAPAN).

4. Increasing of facilities

The job of increasing open-hearth facilities lagged somewhat behind that for the pig-iron manufacturing department. The first-phase basic construction plan was put into effect from 1952. In spring 1953, plans for the second-phase basic construction (from 1954) took shape. Table No 10-31 shows the increase in open-hearth furnace facilities at the end of the first quarter of 1953.

Note: In the second phase of basic construction, plans called for the addition of two 50-ton open-hearth furnaces (and two 8-ton electric furnaces). Information on this matter is covered under section on "Basic Construction".

5. Defects in facilities from the standpoint of capacity and layout.

a. Defects in capacity

(1) Shortage in the capacity of ladle crane

In September 1952, the capacity of the open-hearth furnace was increased to 50 tons, but that of the ladle crane remained the same. This was the major factor restricting the steel output at the time.

According to the load coefficient, there should be a surplus of 20 to 30 per cent in the capacity of the existing 50-ton crane. However, since it is already superannuated, the crane and its cradle were re-enforced. In spite of this fact, the steel output was restricted to 33.5 tons as a result of the load tests by Russian specialists in early 1953. This is a much stronger restriction than the 38 tons of early 1952. For a time, both the 40-ton ladle and the 10-ton ladle used on the electric furnaces were utilized, and the ladle crane and ingot cranes were also mobilized, but operations did not run smoothly owing to a shortage of cranes.

The 70-ton crane that was proposed to be newly built at the time was scheduled to arrive from the USSR in late 1952. But since it had not arrived by late April 1953, it was inevitable that the 1953 plans for steel production had to be extensively revised. The operations of the three open-hearth furnaces were greatly hampered, since the number of cranes remained the same. Painstaking efforts were made in regulating the progress of the operational process.

Note: It seems at the time, however, that the 70-ton crane was sure to arrive soon.

(2) Open-hearth furnace combustion method

The present firing method by means of gas producers is an old combustion method; hence, the heating efficiency is necessarily poor.

(3) Lack of mixers

Since there are no mixers, the hot metal is carried by ladle cars. The ladle is covered while awaiting charging. The lowering of heating efficiency is unavoidable. When a mixer is used, the temperature of the hot metal drops only five degrees Centigrade an hour, but under the present conditions where

there are no mixers, the temperature drops 10 degrees Centigrade an hour. It is also impossible to satisfactorily obtain uniformity in the quality of the products.

(4) Method of laying bricks in the regenerator

The bricks in the regenerator are lain in a cylindrical manner. In this method the consumption of bricks for each ton of steel manufactured is greater than in other methods.

(5) Shortage of charging cranes and ingot cranes

There are two charging cranes and two ingot cranes for the three open-hearth furnaces. Since a high degree of operating efficiency is demanded, and there are miscellaneous uses and periods of waiting, these facilities cannot be considered as being adequate.

b. Defects in the layout

Since there is not much space at the plant site, the plant will become very crowded if the two proposed 50-ton open-hearth furnaces and the one 300-ton mixer are newly built. There will not be any room to even move around. The most difficult problem is that there is no extra space in the raw materials yard. Consequently, the present smoke-stack used by the open-hearth furnaces and the gas producers may have to be moved. When the five open-hearth furnaces are lined up in a row, the idea of setting up the raw materials yard at one end, as is the case now, will prove inefficient. It will probably be necessary to have the raw materials yard directly connected with each open-hearth furnace from the side.

6. Balancing of facilities

a. Coordination with the pig iron manufacturing facilities

Coordination between the pig-iron manufacturing and steel manufacturing facilities will not be re-explained here since it has already been described in III, C, 6, b of this chapter. Preference was given to the construction of new steel manufacturing facilities. Therefore it seems that when the pig-iron manufacturing capacity temporarily fell behind, consideration was given to the idea of supplying pig iron from the Yang-ch'uan Pig-iron Manufacturing Plant.

b. Coordination with rolling facilities

The medium rolling plans for 1953 called for 125,000 tons of billets, sheet bars, and steel stocks.

Originally, the planned operating rate for rolling in 1953 (decided at the end of 1952) was 75 per cent. However, the rolling operation rate of the advanced enterprises in CHINA (AN-SHAN, for example) had already reached 85 per cent at the time. It seems that the realization of this advanced operating rate thereafter became the target of this works, too. Therefore, based on this advanced operating rate of 85 per cent, the maximum amount of steel that can be rolled would be roughly 140,000 tons.

$$125{,}000 \text{ tons} \times \frac{0.85}{0.75} = 141{,}250 \text{ tons}$$

Since the recovery rate (yield rate) in rolling for 1953 is believed to have been roughly 90 per cent (see Note below) and the acceptance rate of steel bloom is 99.5 per cent, approximately 160,000 tons of steel ingots were needed for the medium rolling of 140,000 tons.

$$140{,}000 \text{ tons} \div 0.9 \div 0.995 \doteqdot 160{,}000 \text{ tons}$$

Note: The basis for estimating the yield rate for rolling is as shown below:

Planned amount of bloom rolling	Planned amount of steel manufactured in open-hearth furnaces	Planned amount of steel manufactured in electric furnaces

$$125{,}000 \text{ tons} \div (130{,}000 \text{ tons} + 8{,}100 \text{ tons}) \doteqdot 0.9$$

The original planned steel output for 1953 was 138,000 tons from the open-hearth furnaces (three 50-ton furnaces) and electric furnaces (two 3-ton furnaces) combined. But later (spring 1953), owing to the delay in improving the open-hearth furnace accessory equipment, the planned output was somewhat lowered. However, there were prospects that the improvements in the open-hearth furnace accessory equipment would be accomplished in a very short time. Therefore, it was believed that when these improvements are made and the abovementioned steel manufacturing facilities begin to show high efficiency in production, steel output of 170,000 to 180,000 tons during the year would be achieved. With just these conditions as a basis, it can be said that rolling and steel manufacturing facilities were in a virtual equilibrium even when the rolling department attains the earlier mentioned advanced operating rate (that is, when the amount of steel needed is 160,000 tons).

It was believed, however, that this balance would be upset after 1954 or 1955. This is because in spring 1953, concrete steps were being taken to construct two new 50-ton open-hearth furnaces and two 8-ton electric furnaces and it was believed that they would be completed in 1954 or 1955. Therefore, it can be said that the balance between steel manufacturing and rolling facilities at that time was destined to be upset by the rolling department unless rolling facilities were increased proportionately during this same period. It is reported that to cope with the expansion in the steel manufacturing department, transfer of the small bar mill was being studied for the purpose of strengthening the medium bar rolling facilities.

7. Operational methods

   a. Operational process -- see Chart No 10-25

   b. Operation of the open-hearth furnaces

      (1) Raw materials charging method

      Before the Chinese Communists took control, blast furnaces No 1 and No 2 had operated simultaneously for only a short period of time; therefore, the

supply of molten pig was irregular and generally the "chilled pig and scrap" method had to be used.

There was a rather smooth supply of scrap iron during the Japanese era, but during the Chinese Nationalist era following the war, the supply became rather stringent.

After the Chinese Communists took control, they temporarily followed the method that had been in use. But from about 1950, they switched to the "hot metal and ore" method, which they have continued up to the present day.

(2) Raw material charging order

After the heat is tapped, remnant slag is scraped out and the hearth is readied; then pre-charging begins. First of all, small type steel scrap is charged followed by large type steel scrap. This is then followed by the charging of ingot pig (chilled pig) and iron ore. About half of the limestone is charged at the same time as the steel scrap.

When the temperature of the above charge reaches the stage where it is about to melt, the after-charging starts, in which the hot metal is charged by means of the hot metal charging trough. When the melting is over, limestone is put in. When the refining is completed, the ferroalloy is put in immediately before the heat is tapped.

Since there are no mixers, the hot metal is kept ready on hot-metal cars. During this period small broken up iron ore is put into the hot metal, and compressed air is blown in to speed up deoxidation, decarburization, and desilicification. The idea in mind is to shorten the time needed for refining.

(3) Charging procedure

(a) Charging cold material

The cold material is loaded into charging boxes (capacity, 2.5 tons) in the raw materials yard located at one end. Then it is hoisted onto the deck of the open-hearth furnaces by dollies and distributed to the side of each furnace.

When it is time for charging, the charging box is suspended on the tip of the ram by a charging crane. It is then carried to the front of the open-hearth furnace and charged into the furnace from the charging door in front.

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(b) Charging time

One charging operation takes a minute to a minute and a half, but the overall time is about two minutes. (There are times when only 500 kilograms can be put into the charging box when the scrap is thin. This affects the charging time.) How the charging time has been reduced in the single operation of an open-hearth furnace is shown below.

1 Under Japanese and Chinese Nationalist management (30-ton open-hearth furnaces used): three to three-and-a-half hours.

2 Under Chinese Communist management (last-half of 1952; 50-ton open-hearth furnaces used): two hours.

(c) Hot metal charging

The hot metal is hauled by a ladle car to the place where the ingots are made. It is charged from the charging door on the back wall of the open-hearth furnace by a ladle crane.

The hot metal in the ladle was weighed previously at the entrance of the open-hearth furnace plant. At this time, allowances are made for hot metal sticking to the ladle.

(4) Blowing in of air and gas

(a) The flow of air and gas through regenerators on both sides is reversed every 15 to 20 minutes.

(b) At the flue entrance the gas is 500 to 600 degrees Centigrade; at the entrance of the combustion chamber, 1,200 degrees Centigrade; and when mixed with air inside the combustion chamber, 1,280, degree Centigrade. The gas pressure at the water column is 80 to 120 millimeters.

(c) When the air is blown in, it is 1,000 degrees Centigrade in the flue, and this air is heated up to 1,200 degrees Centigrade after it enters the regenerative chamber. The blowing in of air is regulated by a winch that opens and closes a value (lid) at the air inlet (completely open during melting process, slightly open during refining process).

(d) The Soviet method of steel manufacture has had its influence since the last half of 1952, and the method of blowing in air by a compressor has been adopted. A record of the air blown in is determined from the readings on the CO_2 meter.

(e) Also in use experimentally is the so-called oxygen steel process whereby oxygen is run into the open-hearth furnace by a tube from a gas cylinder.

(5) Use of the Bessemerizing method

This method has been used since 1950 under the supervision of Soviet technicians. This is the method in which a one-inch pipe of five meters in length is immersed in the molten steel and compressed air is blown in. This speeds up decarburization and desilicification (method of shortening the oxidation time).

The pipe is made by rolling up thin iron plates. But since the tips of the pipes melt quickly because of the heat, an open-hearth furnace is equipped with ten pipes for each operation.

There is nothing especially new about this method, but it should be noted that it points out characteristics of the Soviet method of steel manufacturing whereby emphasis is placed on oxidation time which had heretofore been disregarded.

(6) Temperature of the steel bath

The temperature of the steel bath is 1,650 degrees Centigrade. The temperature of the molten steel when tapped is 1,620 degrees Centigrade.

(7) Temperature of the regenerator

The temperature of the regenerator reaches 1,450 degrees Centigrade. The temperature is measured by a pyrometer.

(8) Discharging of waste gas

Waste gas is discharged through a small flue in the regenerator and then out through the smoke stack. It is discharged and replaced with fresh gas and fresh air by the gas reversing valve and air reversing valve.

Note: Recently, a sensitive pressure regulator (a device which regulates pressure by electric currents transmitted from the pyrometer) has come into use. This regulator automatically regulates the pressure of the reversing valves and the adjustments on the large damper. However, in T'AI-YUAN in spring 1953, it was not as yet being used.

(9) High speed assays

Materials are assayed twice to judge the quality of the steel, once immediately after the steel melts and once near the end of the refining process. The main purpose of the first assay is to assay the material to see how much ferro-alloy, etc is to be added, and the second assay is to determine the tapping period.

In order to report the results of the high speed assay promptly to the shop, a signal light is installed in front of the furnace so as to eliminate SHISETSUJI (TN Presumably "time loss") in refining time. This signal light is designed in such a manner that it can show the percentage of components in figures from 0 to 9 and the names of such elements as silicon, manganese, carbon, sulphur and phosphorus.

(10) At the time of tapping, the molten steel (bath) is poured in a ladle, but the slag immediately floats to the top of the bath. This slag is run off into a slag receptacle, but it immediately solidifies.

The slag, since its iron content has no useful value, is disposed of in an open space outside the plant. Normally, the chemical composition of the slag was as shown below, but the CaO/SiO_2 (basicity) of 2.5 to 3.0 was regarded as ideal.

(a) SiO_2 -- 17 to 18 per cent

(b) CaO -- 40 to 50 per cent

(c) Al_2O_3-- 5 to 6 per cent

(d) FeO -- 8 to 9 per cent

(e) Fe_2O_3 -- 5 to 6 per cent

(f) MnO -- 5 to 6 per cent

(11) Tapping is called "opening a hole". A hole is dug from the tap hole into the hearth and tapping is carried out. The tapped molten steel is received in a ladle and after the slag has been removed, it is sent to the ingot casting yard. With skill, the hole-opening operation generally takes five to six minutes, and the bath starts flowing. Sometimes the operation takes as long as ten minutes.

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c. Controlling the heat

(1) Calorific value of the producer gas -- see Table No 10-32.

The calorific value is above normal, since the excellent coal produced at TA-T'UNG is used.

(2) Calories consumed

In the plans for 1953, for each ton of steel manufactured, 1,400,000 to 1,600,000 kilocalories of producer gas were consumed. The basis for this calculation is as shown below.

Amount of gas produced by one kilogram of coal		Coal for manufacturing one ton of steel		Amount of producer gas needed for manufacturing one ton of steel
3 to 3.5 cubic meters	x	330 kilograms	=	about 990 to 1,155 cubic meters

	Calories to one cubic meter		Calories consumed for manufacturing one ton of steel
990 to 1,155 cubic meters	x 1,400 kilogram calories	=	about 1,400,000 to 1,600,000 kilogram calories

From the standpoint of thermal efficiency, it can probably be said that this amount of consumption is far below the present international standard (800,000 kilogram calories when hot metal is the main constituent, and 1,200,000 kilocalories when the main constituents are scrap steel and cold pig).

Note: 1. According to the plans for supply and demand of raw materials in manufacturing steel at this works in 1953, 800 kilograms of hot metal and 275 kilograms of scrap steel were used to make one ton of steel.

2. As reference, shown below is the amount of calories needed to manufacture a ton of steel at the Yawata Steel Works.

a. During the war: 1,300,000 kilocalories

b. Latter half of 1953: 990,000 kilocalories

c. First half of 1954: 840,000 kilocalories

(3) Dispersion of heat -- see Table No 10-33.

(4) Focal point in improving thermal efficiency

The USSR is reported to be presently consuming 800,000 to 1,000,000 kilocalories of heat for the manufacturing of one ton of steel. Consequently it can be said that there is much room

for improving the thermal efficiency in the present setup in Communist CHINA.

Noting this point, Communist CHINA has taken up the subject of raising the thermal efficiency. Since the crux of the matter is found in the imperfect combustion of the producer gas inside the melting chamber of the open-hearth furnaces, one of the main problems is to stop the escape of imperfect combustion gas to the regenerator.

The temperature of regenerators is set at 1,250 to 1,300 degrees Centigrade. At T'AI-YUAN in spring 1953, the regenerator temperature was 1,450 degrees Centigrade, and the heat loss was very great. As a result, the bricks in the regenerator quickly disintegrated. This brought on the inconvenience of necessitating an earlier cold repair. For this reason, a university graduate technician is permanently assigned at the plant to measure the temperature of the regenerator. In this way the plant authorities are trying to find a means of improving the thermal efficiency.

d. Ingot casting operation

(1) The disposition of plates, central runners, and molds

(a) Number of plates (casting pits)

1 During the Japanese and Chinese Nationalist eras: three

2 During the Chinese Communist era: four

(b) Number of central runners

1 During the Japanese and Chinese Nationalist eras: three

2 During the Chinese Communist era: four

(c) Number of molds: 18

(2) Molds

There are various types of ingot cases depending on the sizes of the ingots and the quality of the steel. The two following types were usually used at this plant.

(a) For ordinary steel ingots: Top thickness, 250 millimeters; bottom thickness, 270 millimeters; height, 1,500 millimeters; weight of the steel ingots, 680 kilograms; square-shaped with the large-end down.

(b) For killed steel ingots

The cubical content is the same as those of the molds used for ordinary steel ingots. They are square-shaped with the large-end up and with riser heads attached.

Before the Chinese Communists took control, the ordinary ingot cases weighed about 500 kilograms and they measured 20 millimeters less than those mentioned above.

(3) Teeming method

Bottom-pouring method is used and the molten steel is poured directly from the ladle into the central runner.

(4) Care of molds and life expectancy

After the molds are used, materials such as brick dust that are stuck to it are removed. Then the mold is coated with graphite and put aside. The molds are used about 120 times.

(5) Preheating of the ladles

The ladles are heated by coke-oven gas before they receive the molten steel.

(6) Procedure for stripping operation

(a) Time to start stripping -- 40 to 60 minutes after the molten steel is poured

(b) Temperature at time of stripping -- temperature of the steel ingot, about 850 degrees Centigrade; temperature of the case, about 150 degrees Centigrade

Generally speaking, the ideal temperature of the cases at the time of stripping is 90 to 100 degrees Centigrade and the stripping operation is withheld until the cases cool naturally to that temperature. At this plant, however, the ingots are stripped sooner than normal because of the frequency of use of the cases and because of plate replacing operations.

(c) Method of removing the molds

The case is removed by lifting it with an ingot crane.

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e. Operations of the gas producers

(1) Since there is no directly attached boiler, steam is brought in from the coke-oven boiler through an asbestos-wrapped pipe. It is important that the steam intake be regulated in order to make the combustion inside the furnace uniform.

(2) Air is blown in by blower. When this is done, attention is given so that a large volume of air is blown in to increase the gas calories. The foreman measures air pressure with a pressure gauge and regulates it. (The air pressure is 1.0 to 1.5 kilogram).

(3) Coal is lifted by a 2-ton hoist to the top of each furnace and it is dumped in the hoppers on each furnace. Care is taken to see that the coal (coking coal) does not stick together. Coal of poor coking property is best.

(4) The gas generated in each producer is run to a main pipe, from which the gas is then sent to the open-hearth furnace by a pipe five meters above the surface.

(5) Gasification point

The gasification point is 800 degrees Centigrade. The gas is of three colors: black, white, and pink. The gas, when it is pink is at its best.

The gasification point is 800 degrees Centigrade, but gas temperature drops to 500 to 600 degrees Centigrade at the entrance to the flue. At the entrance to the combustion chamber in the open-hearth furnace, the gas temperature rises to 1,200 degrees Centigrade. The gas is then mixed with air and the temperature rises to 1,280 degrees Centigrade.

8. Improvements in operational technique

Technical improvements achieved as a result of the introduction of Soviet techniques.

a. Increase in the amount of air blown in (put into effect in the first half of 1952)

By adopting the so-called Soviet-type steel manufacturing method, it was possible to increase the amount of air blown in and to speed up decarburization. The air is fed in by a compressor.

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b. Putting into practice the Bessemerizing method (used since 1950)

It was put into effect under the practical guidance of Soviet technicians. This is the method whereby a pipe, five meters long and one inch in diameter, is inserted into the molten steel when the steel is being refined. This is for the purpose of speeding up decarburization and desilicification.

c. Adoption of the oxygen steel manufacturing method

In 1951, an oxygen supplying apparatus was connected with the air reversing valve apparatus on a test basis. The idea was to raise the temperature in the furnace at melting time and to shorten the steel manufacturing time. Oxygen was brought in in oxygen cylinders from an oxygen plant outside the works. The apparatus is a simple one in which oxygen is run through a tube from the oxygen cylinder to the air insertion hole. This apparatus is depicted on Chart No 10-27.

Note: The oxygen steel manufacturing method is one of the methods that the USSR has been boasting about to the whole world. When the air pressure is increased to realize a perfect combustion inside the open-hearth furnace, there is the disadvantage of lowering the regenerator temperature. However, if the oxygen is supplied as it is in this method, it not only eliminates this disadvantage but it also reportedly lowers gas consumption, which is a desirable effect.

d. Regulating the operations of the gas producer

The gas calories can be increased by blowing in more air than steam. Consequently, the foreman (a skilled worker) regulates the amount of air and steam blown in.

9. Labor

a. Distribution of workers engaged in open-hearth furnace steel manufacture -- see Table No 10-34.

b. Changes in the number of shifts

(1) Japanese era

(a) In 1941: single shift system

(b) After the end of 1942: two-shift system

(2) Chinese Nationalist era after August 1945: two-shift system

(3) Chinese Communist era after July 1949: three-shift system

Note: It is reported that by the adoption of the three-shift system, the workers are not as tired as they had previously been, and that their will to produce has risen tremendously.

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c. Working hours

After the three-shaft system was adopted, each work shift lasted eight hours, or nine portal-to-portal working hours. However, since there are two hours of study each day, the actual portal-to-portal time is 11 hours.

d. Degree of workers' skill

(1) Japanese era

In 1941 (two open-hearth furnaces, one generally in operation), the workers were unaccustomed to steel manufacturing operations. Consequently, a lot of time was required to manufacture steel. There were only about two heats turned out every 24 hours.

Note: This inefficiency was also due to the fact that Hsi-shan coal (poor gas content) was used.

The practical training given to workers thereafter gradually began to show, and by February 1942, turnover was about three heats every 24 hours.

(2) Chinese Communist era

There were five or six skilled workers in the open-hearth furnace plant. They supervised and pushed the operations of the entire plant. In 1952, turnover was 3.4 to 3.8 heats every 24 hours.

10. Raw materials

a. Source of principal raw materials

(1) Pig iron

Pig iron is supplied entirely by the pig-iron manufacturing department within the works. During Japanese control, the operation of blast furnaces was irregular, therefore, mostly cold pig iron was used. With the simultaneous operation of the blast furnaces No 1 and No 2 after the Chinese Communists took control, molten pig iron came to be mostly used. Cold pig iron is used at times but the amount is very small.

(2) Steel scrap

In 1953 steel scraps consisted of those widely collected from throughout SHANSI Province, and the Tientsin and Shanghai Areas, and those recovered from the ingot casting and rolling mills within the works (scraps from ingot casting, rejected steel, rolling scraps and miss-rolled products). It seems that the ratio of these two groups of scrap sources was about half and half.

During Japanese control, this mill was dependent on the army for the supply of steel scraps; therefore, no shortage was felt.

During the early period of Chinese Communist control steel output was small and the steel scrap mixing ratio was only about 10 per cent. Therefore, the requirement in itself was not too great. However, the supply of scrap steel was very difficult due to faulty transportation, poorly organized system of collection and the lack of permeation of political influence. In 1951 raw steel was produced by converters as a substitute for steel scrap, but this was soon discontinued due to unsatisfactory results.

After 1952 the demand for steel scrap suddenly increased due to the increase in steel output and especially due to the improvement in the mixing ratio. Insurance of the necessary absolute amount of steel scrap, however, is becoming more difficult in spite of the fact that remarkable improvements have been made in transportation, in the collection system and in the permeation of political influence. It is presumable that this situation still prevails today.

b. Supply of secondary raw materials

(1) Limestone (flux)

Limestones produced in HSI-SHAN and TUNG-SHAN in the vicinity of T'AI-YUAN are being used. Limestone having more than 50 per cent lime content and less than one per cent silicon dioxide content is said to be desirable. This limestone also contributes to deoxidation, desulphurization and desilicification. The amount of limestone charged, including quicklime, is about seven per cent of the steel output.

(2) Quicklime (flux)

Quicklime produced by the roasting furnace of the ammonium sulphate plant within the works is being used.

(3) Fluorite (flux)

During Japanese control, fluorite produced in WU-CH'ENG-CHEN (located 100 kilometers southwest of T'AI-YUAN between FEN-YANG and LI-SHIH on the South T'ungp'u Line) was used, but since the quality was poor, it was replaced by fluorite produced in TSINGTAO.

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The Tsingtao fluorite was used even after the Chinese Communist took control. It has 60 to 80 per cent calcium difluoride content. This fluorite, however, is not used every time steel is manufactured. It is used for regulating the slags. Fluorite was also used in claybricks.

(4) Iron ore (oxidizing agent)

Iron ore equivalent to about five per cent of the steel output is charged as deoxidizing agent. Iron ore used at present is mainly produced in LUNG-YEN, WU-AN and LI-KUO. Of the above, the ore from WU-AN is considered the best because it contains a large amount of ferrous-oxide. Lump ore is specially used to accelerate deoxidation.

(5) Scale (oxidizing agent)

The oxide coating on steel materials which appear at the time of rolling is called battetura in Communist CHINA. It was discarded during the Japanese era but it is reported that the Chinese Communists began to use it from around 1952.

(6) Manganese (oxidizing agent)

Under Japanese control, this mill was mainly dependent upon the manganese imported from INDIA, but when sea transportation became difficult during the latter part of the war, manganese produced in CHING-LO (75 kilometers northwest of T'AI-YUAN) of SHANSI Province was used, or iron ore (manganese content, 7 to 10 per cent) produced in SHOU-YANG of SHANSI Province was used as a substitute.

After coming under Chinese Communist control, manganese ore produced in CHING-LO (50 to 60 per cent manganese content) was used at first, but this source has been mined out. Thereafter, the ferro-manganese (Mn-Fe) produced in AN-SHAN and TIENTSIN, or spiegeleisen produced in YANG-CHUAN has been used. Ferro-manganese is not used too much because its cost is high. It seems that manganese ore (32 to 35 per cent manganese content) produced in LO-P'ING of HUNAN Province is mainly used at present.

(7) Silicon (addition agent)

In autumn 1952 some ferrosilicon (Fe-Si) was manufactured at the electric furnace plant within the works, but at present Tientsin products are being used.

(8) Phosphorus (addition agent)

The supply source of ferrophosphorus for sheet metal is unknown.

c. Mixing ratio of raw materials

After coming under Chinese Communist control, a mixing ratio of 90 per cent pig iron and 10 per cent steel scrap was adopted because of the difficulty in securing steel scrap. In early 1952 the mixing ratio was changed to 75 per cent pig iron and 25 per cent steel scrap by order of the Ministry of Heavy Industry of the Central Government in conformity with the national pig iron supply and demand plan. Thereafter 800 kilograms of pig iron and 275 kilograms of steel scrap were charged for each ton of steel produced. The change in the mixing ratio since the Japanese era is as shown on Table No 10-35.

d. Amount of raw materials charged

The total amount of charge is 120 to 121 per cent of the steel output. A rough estimate of the yield rate of iron content is 93 per cent. The amount of charge in early 1953 was as shown in Table No 10-36 and the order of charge is as shown on Table No 10-37.

e. Amount of raw materials required

The amount of raw materials required in the steel manufacturing plan of 1953 (annual output, 130,000 tons) which was decided upon in late 1952 was as shown in Table No 10-38. According to the revised plan of spring 1953, the planned amount of steel manufacture was lowered to 114,280 tons. It is presumable, therefore, that the amount of raw materials required also decreased about 10 per cent.

f. Supply and demand of raw materials for gas producers

(1) Supply source

Ta-t'ung coal was used in 1953. The quality of this coal is excellent. Steam was supplied from boiler room No 2 of the coking plant within the works.

(2) Calorific heating power

The calorific value of producer gas is about 1,450 kilocalories per cubic meter. This is 200 kilocalories more than ordinarily obtained.

(3) Amount of consumption

The amount of coal consumption in the 1953 plan was 300 to 330 kilograms per ton of steel output. The amount of coal needed for the gas producers to meet the initial steel manufacturing plan of 1953 was 39,795 to 43,775 tons.

This figure can be substantiated from the gas-producing facilities. The method of computation is as follows:

Daily coal consumption by the old facilities	Daily coal consumption by the new facilities	Daily total coal consumption

(13 tons x 6 gas producers) + (30 tons x 2 gas producers) = 138 tons a day

138 tons x 365 calendar days x 0.85 operating rate = 42,780 tons a year

Computation with the daily steel output as the standard would be as follows:

425 tons (daily steel output) x
0.3 to 0.33 ton (coal consumption per ton of steel output) =
127.5 to 140.25 tons a day (daily coal consumption)

Note: The amount of coal consumption by the old facilities (five producers) during Japanese control was 35 to 40 tons a day because each producer consumed seven to eight tons.

g. Motive power

Power is received from the thermal power plant located within this works. The consumption rate is unknown.

11. Production

a. Daily output

(1) Japanese control

There were two 30-ton open-hearth furnaces during Japanese control. One steel manufacturing operation required about eight hours. The daily output during 1942 to 1943, the most active period, was about 150 tons. Due to furnace repairs and difficulty in obtaining raw materials, the period in which the two furnaces were in full operation was short, and the steel output rarely attained the rated capacity. Throughout Japanese control, the maximum output was 170 to 180 tons when the two furnaces were in operation at the same time.

(2) Chinese Nationalist control

There were two 40-ton open-hearth furnaces during Chinese Nationalist control. As regards the daily output, there was not too much difference from that during Japanese control. Especially after summer 1948, the output suddenly decreased because of the difficulty in obtaining raw materials. Finally production became impossible.

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(3) Chinese Communist control

Efficiency in production improved yearly after 1951. In spring 1953, the daily production reached 425 tons. Facilities at that time consisted of three 50 ton open-hearth furnaces. Even with the operational technique of that time, the actual daily output capacity must have been about 560 tons, but due to the super-annuated attached facilities (ladle crane), the actual operation was limited to the 425-ton level.

b. Annual output

The annual output of products meeting specifications was as follows:

(1) Peak before the end of the war (1942)

(a) Two 30-ton open-hearth furnaces: about 36,000 tons

(b) Maximum monthly production: 4,000 tons

(c) Average monthly production: 3,000 tons

(2) In 1949 (the year in which the Chinese Communists confiscated this works) -- two 40-ton open-hearth furnaces: 20,000 to 30,000 tons

(3) In 1952

There were two 50-ton open-hearth furnaces since spring and three 50-ton open-hearth furnaces since September. The steel output for the year was 91,200 tons.

(4) In the 1953 plan

(a) There were three 50-ton open-hearth furnaces

(b) Controlled figure of the Ministry of Heavy Industry in August 1952: 134,000 tons .

(c) Planned figure decided in December 1952: 130,000 tons.

(d) Planned figure revised in spring 1953: 114,280 tons

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c. Computation of the planned amount for 1953

(1) Computation of the figure decided in December 1952

26 square meters (effective hearth area) x
5.44 tons per square meter a day (effective hearth area utilization coefficient) x
3 (number of furnaces in operation) =
425 tons a day (daily output).

425 tons (daily output) x 365 (calendar days) x
0.85 (operating rate) x 0.99 (hot metal recovery rate) x
0.99 (percentage accepted) ≑ 129,200 tons a year (annual steel output)

Note: This computation shows a shortage of 800 tons, but details are unknown.

(2) Computation of the figure revised in spring 1953.

33.5 tons (steel output per furnace per operation) x
$\frac{24 \text{ hours}}{6.4 \text{ hours}}$ (frequency of tapping a day) x
365 (calendar days) x 0.85 (operating rate) x
0.99 (hot metal recovery rate) x
0.99 (percentage accepted) ≑ 114,586 tons a year (annual output of accepted steel)

Note: This computation shows an error of 360 tons but details are unknown.

d. Itemized production

The planned output by items for 1953 (fixed in December 1952) is as follows:

(1) Rimmed steel: 98,700 tons

(2) Killed steel: 8,800 tons

(3) Sheet steel: 22,500 tons

(4) Total: 130,000 tons

Note: Besides the above, a small amount of cast steel is produced for the purposes of making rollers.

It is believed that under the revised plan of spring of 1953, the production of rimmed steel was reduced by about 16,000 tons. The reason for this is that this portion consists of billets for outside sales.

e. Specifications

For details see the "List of Provisional Specifications for Products" entered under section XI of this chapter.

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(1) Classification of steel

(a) No CO -- steel that do not meet specifications; mostly steel with high phosphorus content.

(b) No C1
(c) No C2
(d) No C3
These are called rimmed steel, and are of MC specifications; carbon content, 0.10 to 0.35 per cent.

(e) No C4
(f) No C5
(g) No C6
Killed steel of AC specification

No C1 to No C3 steels are mainly used as construction materials. Sheet steel is mild steel and is classified by its phosphorus content.

No C4 to No C6 steels are used for shafts and structural purposes. The specifications differ from those of JAPAN in that they are somewhat more flexible, but otherwise they are generally the same.

(2) Size (seven different sizes)

(a) Medium size -- three sizes (680 kilograms, 800 kilograms and 1,000 kilograms)

(b) Small size -- four sizes (80 kilograms, 130 kilograms, 180 kilograms and 250 kilograms)

The 680-kg wide-bottom rimmed steel ingot and the 650-kg, wide-top killed steel ingot with riser are the two sizes most commonly used. These sizes will probably not change for a while because they are for mass production of ingots for medium size rolling. Sizes and shapes of commonly used steel are as shown in Chart No 10-28.

f. Distribution of products

All the rimmed steel, killed steel and sheet steel produced under the 1953 plan were to be delivered to the medium bar rolling department within the works. Steel for casting rollers are delivered to the roller plant.

g. Disposition of recovered scraps

Scraps (steel scraps sticking to ladles, gits and plates) obtained from ingot casting and rejected steel are charged into the open-hearth furnace and regenerated.

h. Disposal of slags

Slags are thrown away into a depression which is located outside the plant but within the compound of the works.

12. Production data of open-hearth furnace steel manufacture

a. Effective utilization coefficient of equipment

(1) In the 1953 plan

Equipment utilization coefficient for each furnace was generally 5.44 tons per square meter per day in late 1952

At first this coefficient was the basis for computing the planned output for 1953. The average steel output per furnace computed inversely from this coefficient would be as follows:

26 square meters (effective hearth area) x 5.44 tons per square meter a day (utilization coefficient) $\div$ $\frac{24 \text{ hours}}{6.4 \text{ hours}}$ (frequency of tapping) $\doteqdot$ 37.73 tons (steel output for each heat)

Steel output of 37.73 tons is much too small a figure for a 50-ton open-hearth furnace, but as previously related, this is due to the limitation arising from the superannuated ladle crane. This figure was further reduced to 33.5 tons in spring 1953 as a result of the load test of the ladle crane conducted by Soviet specialists. The effective utilization coefficient in the revised plan, therefore, was further lowered. Computation of this coefficient is as follows:

33.5 tons (steel output for each heat) x $\frac{24 \text{ hours}}{6.4 \text{ hours}}$ (frequency of tapping per day) $\div$ 26 square meters (effective hearth area) $\doteqdot$ 4.45 tons per square meter a day (effective utilization coefficient)

(2) The effective utilization coefficient after the improvement of attached facilities

In spring 1953, an order had already been placed with the USSR for a 70-ton ladle crane which was expected to be newly established. After its arrival, installation, and operation, it is obvious that the effective utilization coefficient will have immediately risen. It is presumed that the steel output per day per furnace in this case would attain 187.5 tons and the coefficient is computed as follows:

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$$50 \text{ tons} \times \frac{24 \text{ hours}}{6.4 \text{ hours}} \doteq 187.5 \text{ tons} \div 26 \text{ square meters} \doteq$$
7.21 tons per square meter per day

b. Steel-making time

(1) During Japanese control

During Japanese control, it required eight to nine hours to manufacture steel with a 30-ton open-hearth furnace. This was probably because the cold pig and scrap iron method (35 per cent cold pig and 65 per cent scrap iron) was then being carried out. Due to repairs and time loss, the frequency of tapping in 1941 was generally twice a day, but in 1942 (the peak year before the war's end) tapping was generally carried out 3.0 to 3.5 times a day.

(2) Chinese Communist control

The hot metal method (molten pig iron 75 per cent; scrap iron, 25 per cent) is enforced. In 1952 the production of steel by the 50-ton open-hearth furnace ordinarily required six hours and 20 minutes to seven hours. The shortest time on record was about five hours and 40 minutes. In the 1953 plan, the time required for manufacturing steel was determined to be an average of six hours and 24 minutes. (3.75 heats a day). This figure is presumed to be equal to the international standard, but Soviet specialists claim that it can be reduced to about six hours and 10 minutes by the "quick steel refining method" which they advocate. It is believed that four charges a day will be realized in the near future.

Breakdown of the average time required in manufacturing steel in the 1953 plan is as follows:

(a) Tapping time: 5 minutes

(b) Inspection, cleaning and minor hot repair inside the furnace: 15 to 20 minutes

(c) Preliminary charging: about 2 hours

(d) Melting time: a little over 2 hours

(e) Refining time: 1.5 to 2 hours

(f) Preparations for tapping: 10 minutes

c. Operating rate (period of operation in one year)

The operating rate has developed into a high rate incomparable to that under Japanese control. The actual output of 1952 was 84 to 86 per cent, and in the 1953 plan the average of each furnace was 85 per cent. This is equivalent to 310 operational days in a year. With each furnace being charged 3.75 times a day, each furnace would be tapped an average of 1,163 times a year. Results of 1952 showed that open-hearth furnaces No 1 and No 2 both exceeded 1,000 tappings during the year.

d. Recovery rate

(1) Recovery rate of raw materials (steel output against amount of charge)

Recovery rate under the 1953 plan was 93 percent because the steel output was one ton for 800 kilograms of pig iron and 275 kilograms of steel scrap, or a total of 1,075 kilograms charged.

Note: The raw material recovery rate is covered in the raw material supply and demand plan but not in the steel manufacturing plan.

(2) Recovery rate of steel ingots (amount of steel ingot against the total steel output)

In the 1953 plan the steel ingot recovery rate was fixed at 99 per cent on the basis of the results attained during the latter half of 1952. In this case the remaining one per cent (unrecovered portion) consists of steel sticking to the ladle and that spilt in teeming.

e. Percentage of products meeting specifications

The percentage of products meeting specifications is the yield rate of accepted ingot for the amount of steel ingot cast from molten steel. The percentage of products meeting specifications under the 1953 plan was fixed at 99 per cent on the basis of the results attained in 1952. Of the other one per cent (rate of rejection), 0.5 per cent is made up of steel ingots on whose surfaces patterns have appeared, those that are imbedded with sand and those which had not completely filled the ingot case, while the remaining 0.5 per cent is made up of those which are rejected in the pickling test.

13. Repair of open-hearth furnaces

a. Classification of repair

Furnace repairs are classified into hot and cold repairs. The number of days required for repair work in both cases is counted as the number of days that furnace operation was suspended. Therefore the reduction in furnace repair time becomes an important factor in the improvement of the open-hearth furnace rate of operation, (de facto extension of the life of open-hearth furnaces). Minor repair works such as throwing in magnesia clinkers or dolomite clinkers are not considered as hot repair work defined by the operational regulations. These repairs were woven into the steel manufacturing time as part of its process, and therefore was not included in the time of operational suspension.

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b. Hot repair

(1) Hot repairs consist of emergency repairs for such damages as to the hearth and other places. They are divided into major and minor hot repairs. This classification is clearly defined in the operational regulations according to the size and depth of the damaged parts.

(2) Minor hot repairs are ordinarily carried out after every 12 or 15 tappings. Scores of shovel-fulls of magnesia clinkers or dolomite clinkers are thrown into the damaged part and pressed with soldering iron to fuse them. The time required for this repair work is about two hours.

During Japanese control it was necessary to carry out a minor hot repair after every seven or eight tappings. Under Chinese Communist control, the quality of raw materials, quality of refractory materials and consideration given from the operational standpoint have contributed much to increasing the number of tappings before each repair.

(3) Major hot repairs are carried out after every three minor hot repairs. The damages become worse after every 40 or 50 tappings; therefore, repair work is done over again. Time required for a major hot repair is 14 to 16 hours.

(4) In the 1953 plan the number of days required for hot repair works over a period of 1,160 tappings was about 15 days. Sometimes hot and cold repairs were carried out at the same time. This was carried out after 50 to 60 minor hot repairs and about 20 major hot repairs.

c. Cold repair

(1) Repair work other than to the hearth -- namely, inside the furnace and regenerator -- is accomplished during cold repairs. Cold repairs are classified into major, medium and minor repairs depending on the extent of the repair and the place requiring the repair.

(2) Minor cold repairs were mostly done when the cooling box of the nozzle leaked or collapsed.

When the furnace temperature drops down enough for people to enter the furnace, the repairman steps inside, removes the damaged part, puts in new bricks, and stamps the magnesia clinkers and dolomite clinkers. In this case various necessary bricks were lined up in the order of the positions they were going to be used. This is done to facilitate the progress of the work.

After the repair is completed it is necessary that heat expansion of bricks be carried out by gradually raising the furnace temperature for about three days. Since the temperature curve should be raised in accordance with the degree of expansion of the bricks at the time of heating, it is carefully illustrated in the operational regulations in detail. Heating is first started by burning firewood in the furnace.

The number of days required for a minor cold repair was more than five days, which included two days and two nights for pure repair, three days for heating and cooling.

(3) Medium cold repairs were mostly those of the roof, nozzle and regenerator.

The roof is replaced when it becomes like a stalactite cave, and the regenerator was cleaned when slags accumulated.

When replacing the roof, the mold frame is supported from underneath and new bricks are laid on top. During Japanese control a rock drill was used when slags solidified, but after the Chinese Communists took control dynamite was used for rapid removal to save time.

The time required from the previous tapping until the start of the next charging of raw materials is about 10 days. Of course this ten days include the time required for cooling, repairing, and heating.

These repairs were carried out after every 240 to 300 tappings. Repairs are carried out three or four times a year.

(4) Major cold repairs are carried out when hearth bricks are replaced or when the checkerwork of the regenerator is replaced. During Japanese control, part of the medium cold repairs was classified as major cold repairs. After the Chinese Communists took control a strict distinction has been established between the medium and major cold repairs.

Hearth bricks were replaced when molten steel leaked from the hearth, and checkerwork bricks were replaced when their surface became tile-like and the absorption of heat became poor.

During Japanese control, major cold repairs were conducted about once every three months, but in the 1953 plan they were scheduled for about once every six months or about once every 500 tappings.

The time required from the previous tapping until the next charging of raw materials ranged from two to three weeks. In this case heating required about one week.

(5) Periods of the foregoing major, medium and minor repairs frequently coincided with each other, and therefore the actual number of days required was about 40 days a year.

Furnace sidewall was replaced about once every five years.

D. Electric Furnace Steel Manufacture

This works started steel manufacturing operations by electric furnaces immediately after the first transfer-project (transfer of facilities from the coastal area) was completed in autumn 1952. At the end of the first quarter of 1953 the second transfer-project was in progress.

Steel manufacturing by electric furnaces at this works, stands on an equal footing with steel manufacturing by open-hearth furnaces in all aspects including plant organization, facilities, and work processes, therefore it has become a specialty of this mill.

1. Facilities

a. Facilities layout -- see Chart No 10-29.

b. Data on facilities -- see Table No 10-40

2. Operational method

a. In the first quarter of 1953, there were no outstanding characteristics in the way of operational method because only a short period had elapsed since operation started.

b. This mill still had a long way to go before it would be able to produce such high quality steel as tool steel, and high-speed steel.

c. In the charging of raw materials, cold materials were of course charged.

3. Raw materials

a. Principal raw materials

(1) Supply source

Raw material consisted mainly of billet scraps, but miss-rolled products and other small steel scraps were also used. Control of steel scrap is strictly carried out from the standpoint of refining.

There is no definite information concerning the supply source of such ferroalloy as ferrosilicon.

(2) Amount required

In the production plan for 1953, the production of good ingot (raw steel) by electric furnaces was fixed at 8,100 tons. It was estimated that the amount of steel scrap needed would be around 9,000 tons when computing from the rates of recovery (steel manufacturing and ingot casting) and acceptance.

b. Electric power

(1) Supply source

Electric power was supplied by the thermal power plant established within the works. No fuel other than electric power was used.

(2) Amount required

Although details are unknown, it is said that about 1,500 kilowatt-hours of electricity is needed to produce a ton of steel. When computing with this figure as the basis, more than 12,000,000 kilowatt-hours of electricity should have been consumed to attain the steel production goal for 1953 (8,100 tons of steel meeting the specifications)

Note: The calorie input for the 1,500 kilowatt-hours of electricity required to produce a ton of steel would be as follows when calculated by the Japanese system:

1,500 KWH x 860 kcal/KWH (unit calorific value) = 1,290,000 kilocalories (electric power calorific value) ÷ 78.4 per cent (percentage of calorie input) = approximately 1,650,000 kilocalories (total calorific value)

The percentage of calorie input is equal to the percentage of the electric power supply calorific value for the total calorific value produced by electric power, oxidizing agent and flux.

The figure 1,650,000 kilocalories seems to be appropriate judging from the present thermal efficiency of open-hearth furnaces in Communist CHINA. However, further study is necessary because we have an empirical impression that it was about 2,000,000 kilocalories in the early stage of operation by open-hearth furnaces.

4. Production

a. Output -- see Table No 10-41

The plan for the first quarter of 1953 called for the production of 1,800 tons of good ingot (raw steel) and the planned total production for that year was 8,100 tons by electric furnaces No 1 and No 2 (rated capacity, three tons each). It was reported that

electric furnace No 3 , (rated capacity, 8 tons), expected to be completed in autumn of the same year, would be used to supplement the foregoing two furnaces in case it becomes difficult to attain the planned output. The amount of production by electric furnace No 3, however, was not included into the plan of the same year.

For reference, Table No 10-41 shows the estimated production for 1954. The figures, however, cannot be expected to be accurate.

b. Products

In the fourth quarter of 1952, carbon steel for structural purposes was mainly refined. Besides the above steel, this mill temporarily produced special steel for gun barrels in behalf of the T'ai-yuan Machinery and Tool Plant which had electric furnace troubles. In manufacturing special steel, ingot cases were borrowed from the T'ai-yuan Machinery and Tool Plant to cast ingots.

The production plan for 1953 was as follows:

Products	First quarter	Annual
Steel ingot (good ingot) for structural purposes	1,300 tons	3,600 tons
Silicon steel ingot (good ingot)	500 tons	4,500 tons

Steel ingots for structural purposes were all killed steel, and consisted mainly of good quality carbon steel for general structural purposes (for use as rails).

Silicon steel ingots were to be rolled into sheets for use in electric motors and transformers. Production was low in the first quarter of 1953 because operation was suspended during January for technical reasons.

During the first quarter of 1953, workers from the workshop department made castings (gears and other items) for machine-tools at this plant. A large quanity was not produced because the molding shop was inadequately equipped. It seems that this shop was used for the sake of expediency only.

c. Specifications

The sizes of ingots conform to those of open-hearth furnace steel manufacture. The quality of steel, as far as carbon steel is concerned, is as previously related in the paragraph dealing with open-hearth furnace steel manufacture.

d. Distribution of products

Products are distributed throughout the nation, espcially to the state-operated mills in CHINA proper. However, silicon steel is shipped to the various mills under the Electric Industry Control Bureau.

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e. Data on production

(1) Effective utilization coefficient

(a) Actual results at the end of 1953

1 Furnace No 1: 11.67 tons per 1,000 kilovolt-amperes per day

2 Furnace No 2: 9.83 tons per 1,000 kilovolt-amperes per day

Calculation of the coefficient is as follows:

1 Furnace No 1: 3.3 tons (each tapping) x $\frac{24 \text{ hours}}{6.5 \text{ hours}}$ (frequency of tapping a day) ÷ 1,050 kilovolt-amperes = approximately 11.67 tons per 1,000 kilovolt amperes per day

2 Furnace No 2: 3.6 tons (each tapping) x $\frac{24 \text{ hours}}{6.5 \text{ hours}}$ (frequency of tapping a day) ÷ 1,200 kilovolt-amperes = approximately 9.83 tons per 1,000 kilovolt amperes a day

(b) Plan for 1953

1 Furnace No 1: 13.69 tons per 1,000 kilovolt-amperes per day (each tapping 3.7 tons)

2 Furnace No 2: 12.00 tons per 1,000 kilovolt-amperes per day (each tapping 4.0 tons)

Calculation of the coefficient is as follows:

1 Furnace No 1: 3.7 tons x $\frac{24 \text{ hours}}{6.5 \text{ hours}}$ x 1,050 kilovolt-amperes = approximately 13.69 tons per 1,000 kilovolt-amperes per day

2 Furnace No 2: 4.0 tons x $\frac{24 \text{ hours}}{8 \text{ hours}}$ x 1,200 kilovolt-amperes = approximately 14.00 tons per 1,000 kilovolt-amperes per day

(2) Recovery rate

The recovery rate (yield rate) of ingot from molten steel was fixed at 98 per cent in the 1953 plan based on the actual results of 1952.

(3) Percentage of products meeting specifications

In the 1953 plan, the rate of acceptance of steel ingot was fixed at 96 per cent based on the actual results of 1952.

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(4) Operating rate

The actual result of 1952 was 80 per cent. The 1953 plan called for 82 to 83 per cent (300 days of operation)

(5) Reason and number of days of work suspension

As in the case of open-hearth furnaces, operation is suspended whenever cold or hot repair is carried out. The number of days that operation was suspended during the 1953 plan amounts to 65 days (including holidays) when inversely calculated from the operating rate.

V. Rolling Department

A. Affiliation and Number of Plants

1. Affiliation

The rolling department is affiliated with the Production Office of the T'ai-yuan Iron and Steel Works and is under the supervision of the assistant superintendent for production (also holds the position of Chief of the Production Office). It is divided into the bloom-rolling and sheet rolling departments.

2. Number of plants

a. Plants affiliated with the rolling department

(1) Medium bar mill

(2) Small bar mill

b. Plant affiliated with the sheet rolling department: sheet mill

B. History

1. When the T'ai-yuan Steel Mill, the predecessor of the present works, was first established before the war, YEN Hsi-shan requested a German engineer to draw up a plan for a medium bar mill and imported a mill from GERMANY as a part of the facilities for establishing an integrated process of steel manufacture.

2. While this plant was still under construction, it was occupied by the Japanese Army in November 1937. With the operation of the pig-iron and steel manufacturing departments, the establishment of a rolling department became urgent. Thus the medium bar mill was completed in August 1941 and operation started from September.

3. Later, with the intensification of the Pacific War, the demand for an increase in local output of steel materials increased. Construction of a small bar mill was started in 1943. This mill started operation from 1944 as an annex plant of the medium bar mill. Equipment of the small bar mill, however, were those which were once scattered throughout North CHINA. These equipment were rebuilt and used at this mill.

It was the policy to use the power source jointly with the medium bar mill, and it was set up so that the small bar mill would be operated when the medium bar mill suspended operation.

4. After the war, this mill came under the management of the Chinese Nationalists, and operation was continued with the prewar facilities. The production of this mill during the most active period was equivalent to several ten per cent of that under Japanese control. Pressure of the Chinese Communist Army, however, became intense after the "Wheat-harvest Operation" which took place in spring 1948. Operation, therefore, was barely maintained. Construction of the roller plant was started during this period.

5. Immediately after this plant came under the management of the Chinese Communists in May 1949 the rolling mill office was bombed and damaged by the Chinese Nationalist air raids. There was no immediate damage, however, to the productive facilities of the mill.

6. Construction of a sheet mill started from late 1951. Progress of the construction was hampered somewhat due to the fact that it coincided with the Three-anti and Five-anti movements which were at their height. For necessary facilities, the sheet rolling facilities laying idle in SHANGHAI were to be collected and transferred here. Parts that were lacking were ordered from the various mills within the country, and thus part of the transfer of facilities was completed in November 1952. Operation with one set (TN Presumably rolling facilities) started from February 1953. At that time there were two sets of sheet rolling facilities at this mill. Great hopes were entertained of this mill because this was the only regular sheet mill under the Chinese Communist administration.

7. In the meantime, the roller plant was completed and the production of small rollers started after 1952.

8. In preparation for the enforcement of the First Five-Year Plan, the Chinese Communists carried out remodeling and construction work from summer through autumn 1952. This work involved the addition of a 400-ton heating furnace and other equipment to the medium bar mill for the purpose of doubling the capaicity of facilities. It also involved the separation of the small bar mill from the medium bar mill for the purpose of effecting full scale simultaneous operation of these mills from winter 1952.

C. Plant Building Layout and Structure

See Chart No 10-30 and Table No 10-42

D. Medium Bar Mill

Due to reasons connected with the power source, the medium bar mill was jointly operated with the small bar mill until autumn 1952. Independent operation became possible from winter of that year because the small bar mill was separated. This mill, however, has clearly indicated that it carries out bloom rolling as its main operation and additionally carries out steel material rolling.

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1. Equipment

a. Layout of mill equipment -- see Chart No 10-31

b. Medium bar rolling equipment -- see Table No 10-43

c. Heating furnace and gas producers -- see Table No 10-44

d. Attached equipment of medium bar mill -- see Table No 10-45

e. Shape of medium-size rollers -- see Chart No 10-32

f. New heating furnace and preheating apparatus -- see Chart No 10-33

g. Old preheating apparatus for the heating furnace -- see Chart No 10-34

h. Structural outline of the lateral conveyor -- see Chart No 10-35

i. Structural outline of the pressure straightener -- see Chart No 10-36

j. Structural outline of the roller straightener -- see Chart No 10-37

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2. Improvement of equipment

a. During the period from autumn to winter 1952, the small bar mill was separated from the medium bar mill and made independent. Thus, the restriction to the productive capacity of the plants, which was heretofore caused by joint usage of equipment, was eliminated.

b. During the period from summer to autumn 1952, a 400-ton heating furnace and a 30-ton gas producer for medium rolling purposes were newly installed. This doubled the medium rolling capacity and made possible the full operation of existing rolling facilities. At the same time, paralleling with this, expansion and augmentation of steel ingot and finished products transporting facilities were completed. Also at the same time, auxiliary facilities such as the cooling pit and steel ingot yard were enlarged.

In spring 1953, the 400-ton heating furnace was mainly used and the 200-ton heating furnace was merely used for heating special products such as silicon steel and special structural steel.

c. Following Chinese Communist control, a special repair shop was established for each project and machinery was quickly and completely installed.

3. Shortcomings in capacity and layout of equipment

a. Shortcomings in capacity

Following Chinese Communist control, the workload for the motors became overloaded because of the adoption of the 24-hour operation system and the increase in the rolling workload. Particularly, during the summer season, motors were liable to become overheated and there was a necessity of suspending operations for the sake of safety. Therefore, in spring 1953, there was a plan to replace the existing motors by large-type motors.

b. Shortcomings in the layout

The plant area is extremely limited and this has been causing much inconvenience in handling steel billets at the cooling pit. Owing to the disposition of the existing facilities of the small bar mill, transportation of steel billets to the small bar mill has been a great hindrance in the overall operation of the medium bar mill. Therefore, in spring 1953, it was reported that the small bar mill will be moved for the purpose of increasing the medium rolling capacity.

4. Coordination of facilities

a. Coordination between the medium rolling facilities and the steel manufacturing facilities

Since information concerning this matter has been given under the steel manufacturing department, it will not be repeated here.

b. Balance between the blooming capacity and the steel rolling capacity

Plans for 1953 called for the total output of 119,000 tons -- 100,000 tons of billets and 19,000 tons of sheet bars. Of this total, 60,000 tons of billets and the 19,000 tons of sheet bars were for use within the works and the remaining 40,000 tons of billets were to be sold to the outside.

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The output of small bar material made from the billets within the works is 54,000 tons and the output of sheet metal made from the sheet bars is 14,500 tons. The medium blooming capacity is 40,000 tons more than the demand for raw material for small bar and sheet metal.

In the said plan, however, since the output of medium bar material was fixed at 6,000 tons, it is quite certain that the above surplus output for outside sale was not the result of limitations in facilities but was rather because of a policy to adjust the demand and supply of commodities.

Originally, the rated rolling capacity of medium bar material was 45,000 tons (nearly 50,000 tons in billets), and including the 60,000 tons of billets for small bar material and the 19,000 tons of sheet bars for sheet metal, the blooming capacity reached about 130,000 tons. Therefore, if the medium rolling process is smoothly carried out without any interruption in the blooming and finishing process, it can be regarded that the blooming capacity (medium bar roughing mill) and the output capacity of steel stocks (medium and small bar material and sheet metal) are in balance.

5. Operational method

a. Medium bar rolling process -- see Chart No 10-38.

b. Transportation of steel ingots

Steel ingots are transported from the ingot casting yard to the medium bar mill by the railways within this iron and steel works, and are charged into a heating furnace by means of a 10-ton crane (15-ton crane before Chinese Communist control).

c. Operation of the old heating furnace

(Following the installation of a parallel-type continuous heating furnace after the Chinese Communists took control, the old heating furnace was used for the heating of special steel ingots such as steel ingots for the electric furnaces).

(1) During Japanese control and Chinese Nationalist control, 12 gas burners were used. Since the Chinese Communists took control, coal has been burned along with eight gas burners.

(2) The air used for gas burners is the heated air sent in by a blower from the preheating device which utilizes waste gas. The air temperature is 150 degrees Centigrade.

(3) Coke gas

Coke gas is transported 450 meters through a 10-inch pipe from the coke oven. However, due to limited supply, coke gas was not used in spring 1953. There was a plan to utilize coke gas in the near future.

(4) Heating period

The heating period was three to four hours.

d. Operation of the new heating furnace

(1) The new heating furnace is operated with 16 gas burners which are installed at two places. The heating furnace uses the producer gas of the gas producer which was newly installed in 1952 as its combustion source but preparations were being made to also use coke gas as combustion source after the second half of 1953. Coke gas is sent through a pipe, which will be extended from the old heating furnace. The pressure of producer gas is 60 millimeters on the water column.

(2) The air used for gas burners is the heated air sent in by means of a blower (powered by a 75-horsepower motor) from the underground preheating device (air generator) which utilizes waste gas. The air temperature is 150 degrees Centigrade.

(3) Scrap blooms, 80 millimeters in thickness, are placed between the charged steel ingots to prevent mutual adhesion of steel ingots.

e. Operation of the gas producer

(1) Coal consumption: 30 tons a day

(2) Coal charging

Coal is transported by dollies and charged into the gas producer with a five-ton crane.

(3) Blowing of air

The air is blown in by a blower powered by a two-horsepower motor.

f. Blooming mill

The heated steel ingots are transported from the new heating furnace to the tilting table of the blooming mill by means of a horizontal automatic rollgang and from the old heating furnace by means of an inclined automatic rollgang. These ingots are then passed through roughing mills. Generally, two or three steel ingots are simultaneously passed through the rolls. After being rough rolled, the blooms are sheared to sizes.

g. Finishing mill

Blooms are transported from the tilting tables of the roughing mills to the automatic roller beds of the No 1 and No 2 finishing mills by means of a conveyor (SHIREPPUCHUGE*) and then passed through the finishing mills. During this process, conveying of blooms is in one direction.

h. Cooling and straightening

Products (steel rails and others), which were processed by the finishing mills, are transported to the cooling beds by means

of rollgangs. During this time, products are cut to a certain length by a sawing machine. The cooled products are further transported to the straightening yard by a 15-ton crane and straightened. The outline of straightening work is as follows:

(1) Bends in the products are straightened by a roller straightener which was newly installed in 1953. This straightener is capable of straightening rails weighing up to 25 kilograms and angle steel weighing up to 100 kilograms. The straightening process can be adjusted to a speed of 50 meters a minute or 65 meters a minute.

(2) A multiple press straightener is used to straighten sectional bends in the products. Rails which were passed through the roller straightener are curved somewhat at both ends. Therefore, these sectional bends are straightened by applying pressure and changing the composition of the steel material. However, straightening by applying pressure on the sides of rails does not change the composition of steel material.

Note: 1. In the case of 30-foot rails, rails with more than 10-inch bends are rejected; therefore, they are straightened by the press straightener. If rails are bent and do not revert to the original form, it indicates that there have been changes in the composition.

2. If rails are bent about 10 inches when they are hot-sawed, they become generally straight after cooling. When these rails are further straightened by passing them through the cambering machine, the method is called the cold straightening method. This method was originated at the Yawata Iron and Steel Co, Ltd but is not practiced at the T'ai-yuan Iron and Steel Works.

i. Finishing of rails

Rails that are straightened undergo final finishing (sawing and boring) by sawing and boring machines.

j. Grade classification

Grade classification is made by paint colors on the cross-section of the billets. This method is the same as that used in JAPAN.

k. Replacement and adjustment of rolls

Replacement, oiling, and adjustment of roughing rolls and rolls for finished products are all done skillfully by the rolling workers themselves.

6. Improvement of operating technique

Attention is given to the prevention of oxidation (burning loss) of steel ingots in the heating furnace, to the increase of efficiency through the adoption of the assembly-line system, and to the improvement of the percentage of finished products meeting specifications. However, detailed conditions are unknown.

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7. Working conditions

a. During Japanese control and Chinese Nationalist control: two-shift system

b. Since Chinese Communist control: three-shift system

8. Raw material and motive power

a. Steel ingots for raw material

(1) Sources of supply

(a) The open-hearth furnace plant and the electric furnace plant of this iron and steel works were the sources for the steel ingot supply.

(b) Under normal operation, there is no necessity for the supplying of steel ingots through purchases from the outside.

(2) Annual supply

(a) During Japanese control and at the peak period under Chinese Nationalist control: approximately 40,000 tons of ordinary steel

(b) Actual result in 1952: 91,200 tons of ordinary steel

(c) The initial plan for 1953: 130,000 tons of ordinary steel; 8,100 tons of electric steel

(d) The revised plan for 1953: 114,280 tons of ordinary steel; 8,100 tons of electric steel

b. Motive power

Electric power for the operation of rolling mills, various auxiliary machinery, and cranes is supplied from the power plant within this iron and steel works.

c. Coal

(1) Coal used for gas producers: Ta-t'ung coal

(2) Coal used for heating furnaces: Hsi-shan coal and others

9. Production

a. Daily output

(1) During Japanese control and Chinese Nationalist control

The daily output of steel material was 120 tons in late 1941, during the early days of

establishment. Subsequently when conditions were good, the daily output reached 150 to 180 tons including billets and steel products (the above situation was during Japanese control). During Chinese Nationalist control after the end of war, the efficiency was generally lower than that during Japanese control.

(2) Under Chinese Communist control (1953 Plan)

(a) In the case of billets only: 500 tons a day

(b) In the case of steel products (average for round bars, square bars, angle steel, and rails): 264 tons a day

b. Annual output

(1) During Japanese control

The maximum annual output was about 30,000 tons and the output never attained the full capacity (45,000 tons) of facilities.

(2) Under Chinese Communist control

The actual output in 1952 was about 82,000 tons consisting mainly of billets. The output was somewhat limited since the small and medium bar mills were operated by the same motor. However, in the latter part of that year, this bottleneck in production was solved by installing a separate motor for the small bar mill and the medium bar mill. Also, as a result of the additional installation of a 400-ton heating furnace during the period from summer to autumn 1952, (a 200-ton heating furnace in the past), the production capacity suddenly increased. Consequently, the daily output of billets exceeded 500 tons, and a shortage of steel ingot occurred when billets were continuously rolled.

Thus, the initial plan for 1953, as shown on Table No 10-46, was 100,000 tons of billets, 19,000 tons of sheet bars, and 6,000 tons of ordinary steel material, to make a total of 125,000 tons. Subsequently (spring 1953), along with the revised steel manufacturing plan, it seems that the planned output of billets to be sold to the outside was automatically reduced by 15,000 tons.

In this manner, practically the full effort in medium rolling is concentrated on bloom rolling. However, this is believed to be the result of the placing of emphasis on the

production of small bar material at rolling mills other than the mills in AN-SHAN and CHUNGKING, and also the result of limiting the casting of small steel ingots in order to increase the steel manufacturing efficiency.

c. Types of products -- see Table No 10-47.

The different types of products are governed by the rolls. As a general trend, however, emphasis was placed on the production of steel material before Chinese Communist control and emphasis was switched to the production of billets (blooms) after Chinese Communist control, particularly after 1952.

Although temporarily, characteristic production items in the past that were capable of being pointed out were sheets (sheets of about 1.6 millimeters in thickness and 100 millimeters in width for fins of trench motar shells) produced under Chinese Nationalist control after the war, and rails (mostly 17-kilogram and some 32-kilogram rails) produced after the Chinese Communists took control (1950 to 1951). This production of rails was to meet the demands for the priority placed on the restoration of railways at that time. The total output reached about 10,000 tons but since then the production of rails has been discontinued.

Principal medium bar material products in the 1953 plan were angle steel, round bars, and square bars. However, as previously mentioned, emphasis in the rolling operations was placed on the production of billets and sheet bars, which are semifinished products.

d. Specifications

Specifications for steel material prior to Chinese Communist control were equivalent to Japanese specifications; that is, No 1 through No 5. Angle steel was equivalent to specification No 2 and rails were equivalent to specifications No 4 and No 5.

The quality of steel now being used under Chinese Communist control will be explained in detail under section XI of this chapter. It seems that sizes of steel ingots vary somewhat. Steel ingots are in the four sizes indicated below.

82 millimeters in thickness by 1,650 millimeters; 87 kilograms (for wire rods)

82 millimeters in thickness by 1,450 millimeters; 76 kilograms

65 millimeters in thickness by 1,650 millimeters; 55 kilograms

65 millimeters in thickness by 1,450 millimeters; 47 kilograms

Also, specifications vary slightly for steel for ordinary use and steel for special use. In regard to steel for special use, specifications for both physical traits and chemical composition are given for some, and specifications of either one of the above two specifications are given for others.

e. Distribution of products

(1) Semifinished products (billets and sheet bars)

(a) Products used within this iron and steel works

All the semifinished products, except billets to be sold outside, are used within this iron and steel works. Billets are sent to the small bar mill and sheet bars are sent to the sheet mill within this iron and steel works.

(b) Products sold outside

Billets sold outside have been shipped to rolling mills in TIENTSIN and SHANGHAI. In early 1952, several thousand tons of billets for flat bars were once returned from the Tientsin Rolling Mill as rejects. Also, a claim was made by SHANGHAI. Billets have never been shipped to the Northeast Area.

(2) Finished products (steel material)

Finished products are forwarded to state-operated construction projects, the machine building industry, and transportation organs. However, details are unknown.

f. Recovery rate

The average yield rate of billets, sheet bars, and steel material from steel ingots in 1953 was 91 or 92 per cent. That is, burning loss was two per cent and steel material waste shavings was six or seven per cent. Details on the recovery rate of blooms and steel material are unknown.

g. Percentage of products meeting specifications, coefficient of effective utilization, and operating rate -- see Table No 10-46.

As previously mentioned, a claim against a large quantity of billets produced in 1951 was made from TIENTSIN and SHANGHAI. However, because of the movement to improve the quality of products after spring 1952, the percentage of products meeting specifications remarkably increased.

h. Number of days of work suspension and reasons for suspension

Calculating from the operating rate, the number of work suspension days in one year is 91 days. A breakdown according to reasons is as follows:

(1) Sundays and holidays: 59 days

(2) Machinery repair (including replacement of rollers): 32 days

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Note: Operation is frequently shut down in summer because of overheating due to shortage of motive power.

i. Repairs

(1) Replacement of rollers

The time required for replacement of rollers in comparison with that during Japanese control is shown on Table No 10-48. Efficiency in the replacement of rollers is higher than the piecework operation in JAPAN. The roller replacement work is said to have become so efficient after the Chinese Communists took control principally because the workers' will to work was remarkably increased through indoctrination.

(2) Repair of heating furnaces

(a) Removal of slag

Slag which remained in the hearth is removed after furnaces are cooled. This is conducted at the rate of once a week.

(b) Relining of the furnace roof

The roof is relined at the rate of once every half a year.

(c) Replacement of rails laid on the heating floor

This is conducted simultaneously with the repairing of the furnace roof.

j. Reprocessing of rejects

Misrolled items and scrap steel are reprocessed as scrap steel for open-hearth furnaces or electric furnaces, according to the quality of the material. The quality is strictly controlled. Scales are charged into open-hearth furnaces as an oxidizing agent in steel manufacturing.

10. Supply and demand of medium rollers

a. Types of rollers used (classification according to the quality of material)

(1) Chilled rollers: only the surface is hard; cast product

(2) Grain rollers: fine granular cast alloy; generally hard up to the center; its cross section resembles steel; cast product

(3) Cast steel rollers: made of ordinary steel; contains less than 0.8 per cent manganese, less than 0.55 per cent carbon, and less than 0.05 per cent silicon; there is more carbon content than normal

(4) Forged steel rollers: forged special steel ingot; forged steel roller is an alloy steel consisting of chrome and other metals and the price is about four times that of a grain roller

Note: 1. Composition, specifications, and usage of chilled rollers will be explained under section XI of this chapter.

2. The weight of each roller in use is about six tons.

b. Supply and demand -- see Tables No 10-49 and No 10-50

(1) Under Chinese Communist control, the supply of rollers became an important issue in the rolling department.

(2) In or about 1951, rollers were ordered from the An-shan Iron and Steel Company but because of the low quality of the rollers, the order was replaced by the Shanghai Roller Plant in the first half of 1952.

(3) In view of the low quality of the rollers, it seems that chilled rollers and cast steel rollers were to be supplied within this iron and steel works but grain rollers and forged steel rollers were to be imported from the USSR. However, because of the very limited rolling of steel material, and also the limited items to be rolled, there is no necessity of high-quality rollers.

(4) The demand for chilled rollers in 1952 was 610 tons, which were all supplied by this iron and steel works. Cast steel rollers are produced at the open-hearth furnace plant, but in view of the steel manufacturing efficiency, production of these rollers is not highly desired at this plant.

(5) Based upon the set standard, the attrition rate of rollers is set according to the tonnage of products to be rolled. However, it varies according to the items to be rolled and therefore, details are unknown.

E. Small Bar Mill

As previously mentioned, small bar rolling at this iron and steel works was heretofore operated as an auxiliary operation of the medium bar rolling and was carried out merely during spare periods in the course of medium bar rolling. However, after late 1952, the small bar mill was separated from the medium bar mill and operated independently.

1. Equipment

a. Layout of the small bar mill equipment -- see Chart No 10-39.

b. Data on rolling equipment -- see Table No 10-51.

c. Data on the heating furnace -- see Table No 10-53.

d. Data on accessory equipment -- see Table No 10-52.

e. Shape of the small bar finishing roller -- see Chart No 10-40.

f. Roller bearing -- see Chart No 10-41.

g. Outline of installation of the small bar finishing roll -- see Chart No 10-42.

h. Structure of the heating furnace -- see Chart No 10-43

i. Operational outline of the suspension lever for small bar rolling -- see Chart No 10-44.

j. Structure of the rollgang -- see Chart No 10-45.

k. Structure of the cooling bed -- see Chart No 10-46.

l. Outline of reeling machine -- see Chart No 10-47.

m. Outline of the portable ground crane -- see Chart No 10-48.

2. Removal and destruction of equipment

There is no pertinent information concerning this matter.

3. Improvement of equipment

Along with the expansion of facilities in late 1952, necessary improvement measures were adopted. Information concerning this matter has already been mentioned according to each facility but combined information is shown on Table No 10-54.

4. Defects of equipment from the standpoint of capacity and layout

The billet conveying route from the medium bar mill was complicated and inconvenient. Consequently, the moving of facilities to the new expansion area was planned in connection with the increase in medium rolling operations.

As in the case at the An-shan Iron and Steel Company, the minimum diameter of round bars is eight millimeters. Cold drawing at a wire rod special plant outside the works is required in making iron wire. As long as the operation is not automatic, a long time will be required to roll 5.5-mm wire.

Note: In JAPAN, wire up to 5.5 millimeters are frequently drawn.

5. Coordination of facilities

Coordination of facilities is the same as that already described in connection with the medium bar mill.

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6: Operational method

a. Operational process -- see Chart No 10-49

There had been no change from the time operations started to the end of the first quarter of 1953.

b. Heating furnace operation

(1) The billets charged are carried from the medium bar mill by a portable ground crane. They are charged into the furnace by an extrusion-type charger.

(2) Heating temperature

Temperature inside the furnace: 1,400 degrees Centigrade

Temperature of the billets: 1,150 to 1,200 degrees Centigrade

(3) Heating time: two hours

(4) The heating furnace is fired with coal.

(5) The frame directly touches the billets.

c. Rough rolling process

(1) Conveying of hot billets

The hot billets from the heating furnace are conveyed and fed to the rollers by two workers operating a suspension lever. They are drawn out at a rate of once every 20 seconds.

Note: In JAPAN, transport rollgangs are used and operations go on at a rate of 150 billets a second.

(2) Rough rolling process

In rough rolling, two billets are usually fed (one billet before the Chinese Communists took control.) Chart No 10-50 shows the roughing roll pass (diamond caliber) and the order of the process.

d. Finishing rolling process

(1) The hot steel material (semifinished products) is led from the roughing roll to the finishing roll by workers. This has to be done in such a way that the material is fed into the roll just right. Much time is consumed when something goes wrong in this operation. The result is that the steel material cools and the passes are damaged.

(2) Chart No 10-51 shows the finishing roll pass and the order of the process. Rhombic-shaped and oval-shaped passes are used alternately.

(3) Aperture of the rolls when wire rods are being rolled -- see Chart No 10-52.

The roll pass in the final process is fairly oval (not perfectly round). The gap between the top and bottom roll depends on the diameter of the wire rods. The aperture is opened as shown below. It is made so that there are no fins left at the time of the rolling.

(1) Diameters of 19 mm, 21 mm, 25 mm and above: aperture 3.5 mm

(2) Diameters of 12 mm and 16 mm: aperture 2.5 mm

(3) Diameters of 8 mm and 9 mm: aperture 2.0 mm

e. Measures to protect the rollers

The rollers are easily damaged when they overheat. Water is run on the face of the rollers and on the axle for cooling purpose. When water is used for cooling, the heat of the steel material is lowered and the shape of the steel material is damaged. However, there is no other way to maintain the life expectancy of the rollers.

f. Coiling of the wire rods

The wire rods that come out of the final finishing rolling mill are not placed in the cooling beds. They are immediately coiled on reels. After they are coiled, they are carried hot to an outdoor storage yard where the wire rods are cooled naturally.

g. Finishing process

The steel stock other than wire rods are extruded from the final finishing rolling mill into the cooling bed trough from where it rolls down to the roller on the other side by the incline of the cooling bed. An automatic roller then carries the steel stock to the shearing machine where they are sheared to specified sizes. They are then conveyed to the assorting table. After the necessary straightening of the steel stock is completed, they are hauled to the outdoor storage yard by dollies.

7. Labor

a. Number of workers

(1) Prior to Chinese Communist control: about 200

(2) In April 1953: about 500

b. Disposition of personnel -- see Table No 10-55

c. Working conditions

(1) Prior to Chinese Communist control: two-shift system in effect

(2) Since 1950: three-shift system in effect

d. Extent of operational skill

(1) Person in charge of the workshop (supervisor)

He was a former shop worker but he completely mastered the supervisor's work at the workshop within six months after he began his work. The adjustment of rollers was directly under the responsibility of the workshop supervisor.

(2) Ordinary rolling mill workers

They generally mastered the ordinary rolling mill operation in two or three months. Hauling of heated steel bloom from the heating furnace is carried out manually instead of through the use of the transport angle. However, the suspended lever is skillfully operated at a rate of once every 30 seconds. As previously mentioned, an extremely high degree of efficiency was displayed in the operation to replace the rollers.

8. Raw material and motive power

a. Raw material for steel blooms (billets)

(1) Source of supply

The medium bar mill in the iron and steel works acted as the source of the raw material supply. No purchase is being made from other plants.

(2) Volume of demand

The volume of demand for billets in the 1953 plan was 60,000 tons. From this volume, it was decided that 54,000 tons of small bar materials (products meeting specifications) would be produced. The volume of demand as well as the volume consumptions prior to 1952 are not accurately known.

Note: Calculated from the production data of 1953 (to be mentioned later), the amount of billets required was slightly less than 57,000 tons. Actually, however, details were unknown.

(Accepted steel material)		(Rate of acceptance)		(Rate of recovery)		(Required volume of billets)
54,000 tons	÷	0.985	÷	0.955	=	57,447 tons

(3) Specifications

There are the following four sizes:

82 millimeters in thickness by 1,650 millimeters in length; about 87 kilograms in weight

82 millimeters in thickness by 1,450 millimeters in length; about 76 kilograms in weight

65 millimeters in thickness by 1,650 millimeters in length; about 55 kilograms in weight

65 millimeters in thickness by 1,450 millimeters in length; about 47 kilograms in weight

Allowable error in thickness and length: of class A product, less than 3 millimeters; of class B product, less than 5 millimeters

b. Motive power and fuel

(1) Motive power (electricity)

(a) Usage: by motors in the mill

(b) Source of supply: power plant in the iron and steel works

(2) Fuel (coal)

(a) Usage: by heating furnace

(b) Source of supply: HSI-SHAN (eight ch'ih /TN One ch'ih equals 14.1 inches/ coal seam)

(c) Quality of coal: small amount of waste after washing; low ash content

(d) Consumption volume: during Japanese control and Chinese Nationalist control, 60 kilograms of fuel was consumed for each ton of steel ingot produced. In those days there was a great deal of waste in the burning of coal on account of the poor rolling efficiency. Under Chinese Communist control (after the heating furnace was improved, when the average daily output of steel stock was 180 tons), the coal consumption was improved to 40 kilograms for each ton of steel ingot.

9. Production

a. Daily output

(1) During Japanese control

At the time of its establishment in 1943, this small bar mill was to operate as an auxiliary mill to the medium bar mill, and although its daily production goal was estimated at about

five tons, it actually produced 20 to 50 tons a day. Throughout the period under Japanese control, however, there were only a few occasions when the small bar mill was operated independently in full scale because of supply and motive power situation.

(2) Under Chinese Communist control

Since 1952, daily output was increased after the small bar mill was separated and made independent, and the production reached 200 tons a day in the first quarter of 1953. The planned daily output for 1953 averaged 201.6 tons for 24 hours. Average effective utilization on the various types of steel stock was 8.4 tons an hour.

8.4 tons an hour x 24 hours = 201.6 tons a day

(3) Change in the daily production volume according to products -- see Table No 10-56

b. Annual output

The planned output of the accepted steel stock for 1953 was 54,000 tons

The computation was made in the following manner.

Daily production volume		Calendar days		Rate of operation		Rate of acceptance		Annual production volume
201.6 tons	x	365	x	0.75	x	0.985	=	54,360 tons

Note: Production volume in 1944 was about 400 tons a month, thus making the annual output about 5,000 tons

c. Products

The majority of products called for in the 1953 plan were square and round bars of which wire rods occupied about 30 per cent.

d. Quality of product and specifications

Details will be stated in section XI of this chapter. Some of the details on wire rods and nail materials are as follows:

(1) Wire rods: C_0 (mildest steel) and C_1(very mild steel); carbon content, 0.1 to 0.3 per cent; diameter, eight millimeters; standard weight, 83 kilograms.

(2) Nail materials: C_2 (mild steel); carbon content, 0.15 to 0.18 per cent; diameter and weight, same as that of wire rods.

e. Distribution of products

Products were sold throughout CHINA. However, wire rods were specially sent to the wire rod plant of the T'ai-yuan Machinery and Tool Plant. Until 1951, wire rods were sent to SHANGHAI, but after 1952, billets have been sent instead.

f. Recovery rate

Yield rate from billet to steel stock differs according to products, but generally it is about 95.5 per cent. In other words, there is a burn loss of two per cent and cut waste about 2.5 per cent.

g. Percentage meeting specifications

The percentage of products meeting specifications called for in the 1953 plan was 98.5 per cent

h. Effective utilization coefficient of equipment

Average effective utilization coefficient for various products in the 1953 plan was 8.4 tons an hour

i. Rate of operation

The planned rate of operation for 1953 was 75 per cent; that is, there were 273.75 working days (6,570 hours) in a year. This number of days indicated the actual working days and did not include days necessary for major and minor repairs or for replacing rollers.

j. Number of days idle and reasons for idleness: similar to that indicated for medium bar mill

k. Reprocessing of recovered scrap

Misrolled products and scraps are reprocessed as scrap steel for open-hearth furnace.

10. Replenishment and equipping of small rollers

a. Supply situation -- see Table No 10-57

From 1952, the production of rollers was started in this iron and steel works, and self-sufficiency in rollers was generally attained since 1953.

b. Life of rollers and frequency of replacement

The life of rollers differed according to the types of steel, quality of products, and usage. In 1952, small bar finishing rollers were replaced with new ones at the rate of 10 rollers for each stand during one year. In 1952, the frequency of replacement was once in two full days for roughing rollers and once a week for finishing rollers.

F. Sheet Mill

1. History

a. Construction of the mill

(1) After the T'ai-yuan Iron and Steel Works came under the control of the Chinese Communists, the

construction of a new sheet mill in the works was decided upon. The Iron and Steel Control Bureau of the Central Government's Ministry of Heavy Industry specially established the Shanghai Engineering Office in SHANGHAI where the planning for the mill was undertaken. The essential machinery and facilities found in the various factories in SHANGHAI were assembled and parts which were lacking were replenished by having them manufactured in SHANGHAI and T'AI-YUAN.

Transfer of the facilities from SHANGHAI to T'AI-YUAN was started from about April 1952. The new construction of buildings in T'AI-YUAN was begun in November 1951 and completed in August 1952. The installation of the entire equipment was completed by the end of the same year.

(2) During this period, the Shanghai Engineering Office had great difficulties in assembling the equipment and in handling the shortage of equipment and parts owing to the lack of technical knowhow. Hence, the Office submitted a questionnaire made up of 20 questions to the Iron and Steel Control Bureau in PEKING.

However, at that time, there was no one at the Iron and Steel Control Bureau who could give appropriate answers to the questions, and finally the questionnaire was forwarded to the T'ai-yuan Iron and Steel Works in its original form. Therefore, the Japanese rolling mill engineer of the works was assigned the job of supervising the construction project.

The Japanese rolling mill engineer accompanied by KAO Hung (高紅 - STC 7559/4769) (Party member of technician grade), superintendent of the sheet mill, made two field trips to the Shanghai Engineering Office during the period from January to March 1952, and again in June of the same year, and assisted the office in assembling the equipment as well as in designing the equipment and parts which were lacking.

b. Training of staff workers

From a group of rolling mill workers who received training from the Japanese engineer on several occasions since November 1951, 60 competent workers were selected and were given practical training for six months from June to November 1952 at the An-shan Iron and Steel Company's Sheet Mill No 1 in the operation of the 26-inch diameter rollers of the sheet mill.

When the 60 workers returned after completing their training, two skilled workers accompanied them from AN-SHAN and supervised the workers for actual operation in T'AI-YUAN.

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Note: It is said that apprentice work at workshops where norm systems were in force was based chiefly on observation and listening, and hence, the apprentice workers were seldom allowed to participate in actual work.

c. Commencement of operation

Trial operation was held in January 1953, and the actual operation commenced in February of the same year. At the start, the steel blooms (200 tons) imported from the USSR was used as raw material, but later the mill used steel blooms produced at the medium bar mill of this works. Rolling equipment were divided into two different groups, and only group No 1 was operated during the day. The mill adopted the policy of contributing toward increased production in the future by placing a strong emphasis on the training of workers.

2. Equipment

a. Layout of sheet mill equipment -- see Chart No 10-53

The heating furnace and rolling equipment of the sheet mill were arranged so as to facilitate the full operation of two sets of rolls.

b. Data on sheet mill -- see Table No 10-58

c. Data on various types of furnace facilities -- see Table No 10-59

d. Data on accessory equipment -- see Table No 10-60

e. Cross section of the heating furnace -- see Chart No 10-54

f. Cross section of the foil sheet furnace -- see Chart No 10-55

g. Sheet roll coupling -- see Chart No 10-56

h. Three-speed reduction gear -- see Chart No 10-57

i. Structure of continuous annealing furnace -- see Chart No 10-58

3. Improvement of equipment

No improvement on the rolling mill was noticeable.

4. Defects in the capacity of equipment

a. Out-dated equipment

Sheet rolling machinery transferred to the T'ai-yuan Iron and Steel Works were old-model machinery which had been in use for 15 to 16 years before the war at the Nakayama Steel Works. That is, these machinery were manufactured by the Nakayama Steel Works in 1927, using the machinery manufactured by the Yawata Iron Works in 1921 as models. These machinery were transferred to SHANGHAI in 1943 and then to T'AI-YUAN in 1952.

b. Lack of plating equipment

There was no plating equipment at this sheet mill; consequently, its finished products were limited only to black sheets. It is said that there was a plan to install plating equipment in spring 1953. A supervisor of this mill (a Chinese of technician grade) visited a Japanese engineer at the T'ai-yuan Machinery and Tool Plant and inquired about plating technique. However, the questions asked were said to be of very elementary nature.

c. Lack of warehouse for storing products

Since the sheet mill had no warehouse for storing products, the finishing shop was disorderly and congested. In April 1953, suggestions as to the construction of a warehouse equipped with a crane or expansion of the existing finishing shop were expressed, but these were not carried out because of budgetary limitations.

5. Layout of equipment

Since the mill was newly constructed and designed effectively in anticipation of mass production in the future, the layout of the equipment was good. If there is any weakness to speak of, it is in the lack of rail facilities (dollies are used at present) linking this mill and the medium bar mill.

6. Operational method

a. Operational process -- see Chart No 10-59

Method of sheet rolling at this works is based on the foil sheet rolling method, but there are slight differences according to the thickness of the sheets.

When the sheet is more than one millimeter in thickness, doubling is not necessary, and hence only one heating by the foil sheet furnace is necessary. However, when the sheet is less than 0.6 millimeter in thickness, it has to be folded two to four times; hence, the sheet had to be heated twice by the foil sheet furnace.

Note: 1. Breakdown sheet or continuous rolling method is not used.

2. For sheet gauges less than three millimeters in thickness, BWG was used similar to that in JAPAN.

b. Transporting of raw material

Raw material (sheet bar) is transported to the mill's outdoor storage yard from the medium bar mill. It is then loaded on dollies by a locomotive crane and hauled to the processing yard of the mill.

c. Shearing

The sheet bars are sheared according to the size of the products.

When the operation of this mill began (in February 1953), the shearing measurement was 12 millimeters in thickness, 200 millimeters

in width, and 650 millimeters in length. Later, when the shearing was considerably mastered (after April 1953), the shearing measurement was 12 millimeters in thickness, 200 millimeters in width and 950 millimeters in length.

Note: Sheet bars which were transported from the medium bar mill was six times (the length of) the shearing measurement with 50-millimeter margins added for cut waste. Hence, the length of sheet bars which were transported to this mill in April 1953 was 5,700 millimeters (12 millimeters in thickness, 200 millimeters in width, and 108 kilograms in weight).

d. Material heating

Sheared sheet bars are continuously charged into the heating furnace in a single line by the charging machine and then heated. The fuel used is producer gas which is blown into the furnace by the burner. The temperature is regulated. The maximum heating time is 2.5 hours, and heating temperature is maintained at 900 degrees Centigrade. The heated material is pincered out through the large front door.

e. Roughing rolls -- see Chart No 10-60

(1) Changes in the thickness during roughing roll processing (in the case of products with thickness of 1.2 millimeters)

(a) Material (thickness): 12.0 mm

(b) First processing (thickness): 9.0 mm

(c) Second processing (thickness): 7.0 mm

(d) Third processing (thickness): 5.5 mm

(e) Fourth processing (thickness): 4.3 mm

(f) Fifth processing (thickness): 3.3 mm

(2) As shown in the following chart, two pieces of sheet bars are usually fed successfully into roughing rolls two at a time. When the first sheet bar reaches position C indicated in the chart, the second sheet bar is fed in the roll. Thereafter, the operation was repeated in a similar manner at intervals of one roll.

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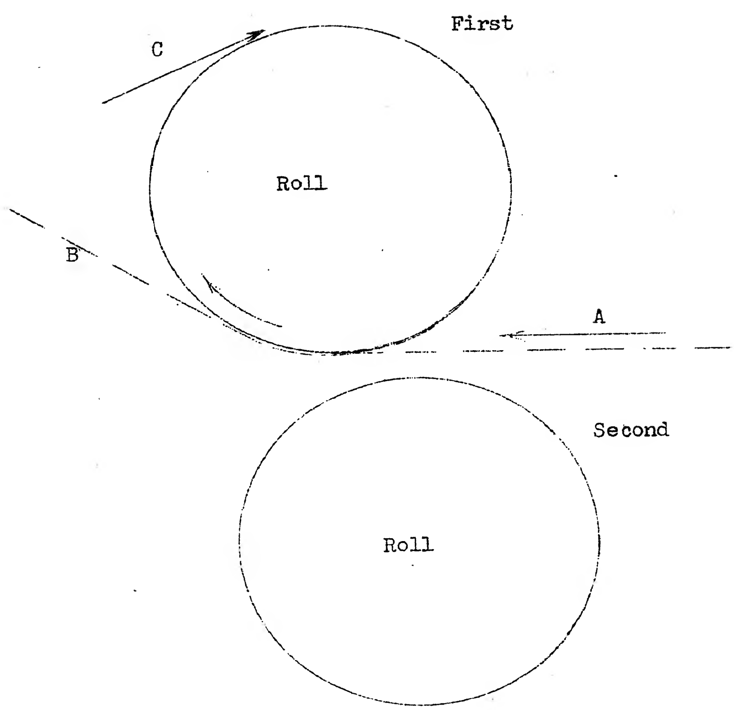

(3) Time required for one roughing roll process is 20 seconds.

(4) When a material of 200 millimeters in width and 12 millimeters in thickness is rolled to a thickness of 3.3 millimeters, its width will have increased to 750 millimeters.

$$200 \text{ mm} \times \frac{12 \text{ mm}}{3.3 \text{ mm}} = \text{approximately } 750 \text{ mm}$$

(5) Function of drag roller (friction roller)

A drag roller is installed at the end of the rolling mill. Its function is to smooth out the turning of rollers by tightening the rollers from top and bottom in order to prevent the steel plate from flying out from the turning rollers which are momentarily halted when the steel plate passes through the rollers. In other words, its function is opposite that of the flywheel.

f. Operation of foil sheet furnace

(1) Raw material which had undergone the primary roughing roll processing or material processed

by the doubling machine is charged into the foil sheet furnace.

(2) Three sheets were charged at a time in the furnace; one sheet placed upright on each side and one sheet laid on the hearth.

(3) Method of heating

(a) A large amount of unburned gas (very smoky) is passed through in order to prevent oxidation.

(b) Temperature inside the furnace is 900 degrees Centigrade. Temperature of raw material is 800 degrees Centigrade.

(c) Heating time is three minutes.

(d) Excess heat is not recovered.

g. Finishing roll

In the finishing roll processing, changes in thickness are as follows (when the thickness of products is 1.2 millimeters):

(1) Semi-finished products (passed through roughing roll): 6.6 millimeters (double layers)

(2) First processing: 5.0 millimeters (double layers)

(3) Second processing: 4.0 millimeters (double layers)

(4) Third processing: 3.2 millimeters (double layers)

(5) Fourth processing: 2.8 millimeters (double layers)

(6) Fifth processing: 2.4 millimeters (double layers)

Since the thickness was for double layers, the product will have a thickness of 1.2 millimeters when the fifth processing is completed.

h. Shearing and separation

Both ends of the material were sheared by the eight-shaku shearing machine to a specified length, and both sides were sheared by the four-shaku shearing machine to adjust the width (finishing shear). Then the products sticking together were separated.

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Note: Silicon steel plate is easy to separate, but the rollers damage easily due to chemical reaction, and holes are easily made in the steel plate.

i. Roughing straightener

Generally, when rolling is completed, the steel plate has a concave warp which is straightened by pressure under the cold roller. The steel plate becomes slightly concave-shaped because the midsection of the rollers becomes slightly convex-shaped due to expansion during the process of rolling.

Note: During rolling, the rollers are heated to 400 to 450 degrees Centigrade, and appear red at night. The axle of the rollers are water-cooled, but the midsection expands because of the heat.

Ordinarily, the midsection of rollers is shaved to a concave shape in order to counter the expansion. When the surface of this midsection expands and becomes perfectly level, true products are obtained.

j. Annealing

After rough straightened, the steel plates are packed in annealing boxes and loaded on flat cars (10-ton loading capacity). These flat cars are then rolled into the continuous-type annealing furnace. Twelve flat cars are simultaneously rolled into the annealing furnaces. During this process, the steel plates does not change, but a change in its composition takes place, causing a softening in the quality of steel.

The annealing box cuts off the outside air and prevents the oxidation of the steel plates through the lack of air in the box. In other words, oxide coating does not form.

The temperatures are as follows:

(1) Temperature of annealing box when it is charged: ordinary temperature

(2) Temperature of annealing box in the heating chamber: 1,000 degrees Centigrade

(3) Temperature of annealing box in the cooling room: 400 degrees Centigrade

(4) Temperature of annealing box after being taken out: 100 degrees Centigrade

(5) Annealing time (from charging till extraction): 35 hours

In the operation of the continuous annealing furnace, a large number of annealing boxes is required. Moreover, in the case of small volume annealing, a single-type annealing furnace is used. In this process, only two charging flat cars are used. The heating time is 24 hours.

k. Finishing straightening

Seven to eight annealed steel plates are placed one over the other and passed through a multiple-shaft type sheet straightener to complete the final finishing. That is, seven top-and-bottom rollers (backup rollers) are placed in line in a row and the steel plates are passed through them. The multiple-shaft type sheet straightener in this mill operates in one direction.

l. Other operations

(1) Preheating and gradual cooling of rollers

In order to prevent damages to rollers, the rollers are pre-heated in the roller pre-heating bed before being used, and after usage, they are cooled in the roller cooling bed. The rollers break easily if they are suddenly heated or cooled. The pre-heating bed is heated by gas.

Note: In JAPAN, a roller preheater is generally used. (This is a device to heat rollers by electric heater after rollers are set up.)

(2) Shaving of rollers

Roller-lathe is used for shaving rollers to obtain proper surface. Speed of revolution of roller-lathe is 1.5 revolutions per minute on the surface of the roller.

Note: The roller-lathe at this mill is different from those used at the medium bar mill in operation and speed.

(3) Boiler operation

Steam pressure -- ordinary pressure -- in operation is 60 pounds. One boiler is in reserve.

Note: Fifteen pounds = one barometric pressure = 760 millimeters on the water column.

(4) Gas producer operation

The Wood-type gas producer (coal consumption 30 tons a day) is used. Coal is hauled up to the third floor by a coal hoisting tower, and dumped in the hopper on the second floor and then fed into the gas producer on the first floor.

7. Working condition

a. Number of workers (January 1953)

(1) Total number of workers: 291

(2) Breakdown

(a) Exclusively daytime workers: 36

(b) Workers on three shifts: 255

(c) One shift: 85

Note: 1. This figure does not include workers held in reserve to replace injured or sick workers.

2. This figure does not include workers for dining room, bath room, and dressing room.

3. In January 1953, only set No 1 was in operation.

(2) Number of basic employees and workers under training (breakdown of workers in three shifts)

(a) Basic employees: 65

(b) Workers considered to be under training: 190

Note: 1. Basic employees are composed of workers who received training at the An-shan Iron and Steel Company in 1952. The rest are generally considered as apprentice workers.

2. The two workshop supervisors who were sent from the An-shan Iron and Steel Company were registered at AN-SHAN.

(3) Breakdown of daytime workers

(a) Office workers: 18

(b) Repairshop workers: 18

(c) Total: 36

b. Disposition of personnel -- see Table No 10-61

8. Raw material and motive power

a. Raw material

At the commencement of operation, 200 tons of sheet bars were imported from the USSR and trial production was conducted. Thereafter, sheet bars are supplied from the medium bar mill at the works.

The amount of sheet bar demand in the 1953 plan totalled 19,000 tons; 4,500 tons of silicon steel (electric steel) sheet bars, and 14,500 tons of ordinary steel (open-hearth steel) sheet bars.

The sheet bars were 12 millimeters in thickness, 200 millimeters in width, about 5,700 millimeters in length and about 108 kilograms in weight.

b. Motive power and fuel

(1) Electric power for rolling mills, various other machinery, and the crane is supplied from the power plant in the works.

(2) Fuel required for the heating furnace, foil sheet furnace, and annealing furnace is supplied by producer gas under direct control of this mill.

Ta-t'ung coal is used by the gas producer. Bony coal (Hsi-shan coal and Fu-chia-t'an coal) obtained after the coal is washed for coking purposes is chiefly used for the boilers.

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9. Production

a. Trial production

Trial production by set No 1 was begun in February 1953. The other set was not as yet in operation in March 1953.

Operation during this period was planned primarily for the purpose of testing the machinery and for the training of workers.

However, according to plans, full-scale production was expected to start from April 1953.

The size of the products during the trial production was 1.2 millimeters in thickness and 1,800 millimeters in length. The width was 600 millimeters in February but it was later changed to the standard size of 900 millimeters.

b. Daily output (first quarter of 1953)

As it was immediately after the beginning of production, normal operation was not as yet underway. Nevertheless, the daily output was generally about 30 tons.

The estimated output of the two sets under full operation is shown in Table No 10-62.

c. Annual output

Since trial operation had commenced from January 1953, and because there was an unknown factor in determining the completion time of the machinery facilities, the sheet production plan for 1953 could not be determined at the end of 1952. Hence, the mill authorities, after tentatively setting the annual output at 20,000 tons as the normal operating capacity, roughly estimated the output for the 1953 plan as 14,500 tons for nine months of operation.

d. Itemized production

(1) Plan for 1953 -- see Table No 10-63

(2) In spring 1953, this mill was the only plant in all CHINA that could produce three shaku by six shaku sheets of ordinary steel and silicon steel.

Note: At that time the facilities at Sheet Mill No 1 of the An-shan Iron and Steel Company were formerly used for making conduit tubes. Hence, the width was limited to two shaku. Sheet Mill No 2 of AN-SHAN, which specializes in sheet production, was completed in July 1954.

e. Distribution of products

Products are distributed to the state-operated plants throughout CHINA (including the Northeast Area).

Note: Silicon steel plate was planned to be distributed particularly for use in electric motors and transformers.

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f. Recovery rate

The yield rate of 1.2-millimeter plates from sheet bars during the period from February to April 1953 showed the following increase:

(1) In February 1953: 85.5 per cent

Material 12 mm (thickness) x 200 mm (width) x 650 mm (length (12.25 kg)
→ product 1.2 mm (thickness) x 600 mm (width) x 1,800 mm (length) (10.17 kg)

(2) In April 1953: 85.25 per cent

Material 12 mm (thickness) x 200 mm (width) x 950 mm (length) (17.90 kg)
→ product 1.2 mm (thickness) x 900 mm (width) x 1,800 mm (length) (15.26 kg)

Note: The recovery rate of sheet under one millimeter in thickness is unknown.

g. Percentage of products meeting specifications

The percentage was estimated at about 90 per cent when computed from the planned production figures of sheet metal and sheet bar, and from the recovery rate mentioned above. The calculations are as follows:

(1) For silicon steel plate

4,500 tons (sheet bar) x 0.85 (recovery rate) = 3,825 tons (product) x X (accepted rate) = 3,500 tons (accepted product) X = approximately 91.5 percent

(2) For ord nary steel plate

14,500 tons (sheet bar) x 0.85 (recovery rate) = 12,325 tons (product) x X' (accepted rate) = 11,000 tons (accepted product) X = approximately 89.2 per cent

10. Replenishment and equipping of rollers for rolling sheets

a. Replenishment

(1) Owing to the construction of a new sheet mill, Japanese-made chilled rollers which were scattered throughout SHANGHAI were assembled and utilized for the operation of the mill in spring 1952.

As for future plans, self-sufficiency through the roller plant located within the iron and steel works was contemplated, but the roller plant was still on trial operation in April 1953. Therefore, plans were being made to import rollers from the USSR until the roller plant's operation becomes successful

(2) The number and quality of the rollers assembled at SHANGHAI were as follows:

(a) Number of rollers

1 Sheet roller (diameter 750 mm, body length 1,150 mm) : 70

2 Cold roller: 15

3 Total: 85

(b) Quality of the roller

1 Hardness 70 to 75 degrees

2 Thickness of the chill: 20 millimeters

Note: There was no grain roller. Grain roller is used for rough rolling in JAPAN.

b. Breakage of roller

(1) In a period of about three months from late January to 20 April 1953, the number of sheet rollers in storage decreased to half the original number. At that time, the breakage of rollers occurred at a rate of one every two to three days.

(2) The cause and rate of breakage were as follows:

(a) Breakage caused by heating: 60 per cent (bent from twisting because of heat during operation)

(b) Breakage caused by mechanical reasons: 35 per cent (processing of improper material)

(c) Breakage caused by poor quality: five per cent (many blow holes, cracks, etc)

(3) Section of breakage: the roller frequently broke from the center

c. Diverting the rejected cold roller products

The cold roller is only slightly effected by heat, but since it receives resistance from cold rolling, the chill decreases due to friction. Therefore, the rejected cold roller products were being diverted to drag rolling.

VI. Casting Department

A. Affiliation and Number of Plants

1. Affiliation

Affiliated to the Production Office of the T'ai-Yuan Iron and Steel Works, the chilled casting Department is set up under the control of the assistant superintendent of production.

2. Number of plant

Chilled casting plant: one (although the building is large enough to accommodate two plants, the space for one plant was occupied by the electrical repair department in spring 1953)

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B. History

1. During Chinese Nationalist control after the war's end, the Yu-ts'ai Machinery and Tool Plant (the present T'ai-Yuan Machinery and Tool Plant) began producing rollers to be used by the T'ai-Yuan Steel Mill (the present T'ai-Yuan Iron and Steel Works). However, the quality of the rollers was poor and only about 20 per cent of the products were usable. Owing to the urgent need for rollers thereafter, the T'ai-Yuan Steel Mill planned on supplying its own rollers and constructed a roller manufacturing plant (the present chilled casting plant) within its compounds. However, the roller manufacturing plant was taken over by the Chinese Communists in April 1949 before it went into production.

2. After coming under Chinese Communist control, the roller manufacturing plant was not operated. In the meantime, the T'ai-Yuan Iron and Steel Works purchased chilled rollers from AN-SHAN in 1951 and from SHANGHAI in spring 1952. However, owing to the difficulty in securing good quality product and for the prupose of supplying its own rollers and for partial sales to outside sources, the operation of the roller manufacturing plant was planned. In 1951, a new 15-ton reverberatory furnace was constructed and the plant commenced operation from 1952. Although the product cannot be called perfect, the production of small bar chilled rollers, of which about 70 per cent were usable, had been attained in April 1953. However, the production of medium bar roller was still in a trial stage at that time and it is judged that the production of good quality products would be difficult even at the present time.

Note: In April 1953, the T'ai-Yuan Machinery and Tool Plant was not engaged in producing rollers.

C. Plant Building

1. Floor space

a. Plant No 1 (chilled casting plant in operation)

(1) At the time of the construction during Chinese Nationalist control: 31 meters in width and 75 meters in length

(2) Enlargement in late 1951: both ends extended 10 meters

(3) April 1953: 2,945 square meters

b. Plant No 2 (plant utilized by the electrical repair department)

(1) Newly constructed along with the enlargement of Plant No 1 in late 1951.

(2) April 1953: 37 meters wide and 75 meters long; 2,775 square meters in area

2. Structure

a. Plant No 1 -- see Chart No 10-61.

(1) Framework: iron frame, and two-ply angle iron was used for the main rafters.

(2) Roof: ferroconcrete block roof

Note: There was a shortage of material during construction, and a shortage existed even in corrugated iron plates for roofing. At that time, the foundry superintendent insisted on a tile roofing laid over wooden boards. However, owing to the difficulty which existed even in obtaining wood, the suggestion of a Japanese technician was adopted and the ferroconcrete block roofing was decided upon. Some fears were expressed in regard to the load stress, but nothing had happened up to April 1953.

The ferroconcrete block was 700 millimeters in length, 500 millimeters in width and 25 millimeters in thickness. The reinforcing bar (old used rails) had a diameter of six to nine millimeters. The holes were painted with pitch.

b. Plant No 2 -- see Chart No 10-61

(1) The framework was made of iron. Since the span in general was far apart, four-ply angle iron was used for the rafters.

(2) The roof was made of corrugated iron plates.

Note: The corrugated iron plates were imported via HONGKONG. They were of Japanese make and they were six shaku by 2.5 shaku. The bolts used for holding down the roof were made within the iron and steel works.

D. Equipment

1. Main equipment - see Table No 10-64

2. Equipment utilization

It was difficult to determine the degree of coordination in equipment because the reverberatory furnace was operated at a rate of about once every few days in 1952.

It is perceivable that complete operation did not materialize at that time because of the difficulty encountered in chilled casting technique.

Operation of the converters was impossible because of errors in its construction. In spring 1953, the converter was abandoned.

E. Operational method

1. Operational procedure

a. Reverberatory furnace

Raw material charging → Reverberatory furnace operation → Tapping → Ingot molding and casting → Roller manufacture

b. Cupola

Raw material charging → Cupola operation → Tapping → Ingot molding and casting → Manufacture of machinery parts

2. Operation of the reverberatory furnace

During the charging of raw material, large size materials such as rejected rollers are charged through the top of the furnace by removing the lid, (however, large size raw materials cannot be charged into the cupola.)

Coal is burned directly for heating. This process directly heats the raw material and at the same time, utilizes the reflected heat of the furnace wall (agalmatolite brick).

Testing of sample is strictly enforced during melting and the composition is regulated by adding ferroalloy. (However, in the case of cupolas, the composition is fixed during initial charging and cannot be adjusted during melting).

In general, the melting period is about seven hours, including about one hour that is required for adjusting the composition.

Generally, 15 minutes is required for tapping and casting.

3. Chilled roll casting method

See Chart No 10-62 for details on ingot molding and casting

4. Skill of workers

Two to three workers were selected and these workers received guidance under the Japanese engineer for about one year. However, only one of them was very conscientious and became rather skilled in the operational process.

After the Japanese technicians were repatriated, the above mentioned person was the only worker who could more or less continue the work. However, it is very doubtful that the operation could be conducted in full because extreme skill is required for adjusting mixtures and mixing raw material pig iron for the reverberatory furnace operation.

F. Raw Materials

1. Source of raw material

a. Raw materials such as foundry pig iron, chilled casting scraps, scrap steel, limestone and iron ore are supplied from within the iron and steel works.

b. The source of supply of ferroalloys (Fe -P, Fe -Si, Fe -Mn, etc) is unknown.

c. Since it is reported that charcoal pig iron is being used for raw material pig iron, there is a probability that primitively produced pig iron is purchased from outside.

d. Ta-t'ung coal is used as fuel.

Note: The limestone neutralizes the acid and eases the flow. Iron ore is used because of its decarburization and desilicifcation actions.

2. Raw material demand

The actual output of chilled castings in 1952, including rollers and machinery parts, was 610 tons (accepted volume). Therefore, the raw material demand for the same year was observed at about 1,000 tons. Raw material mainly consisted of chilled roller scraps.

Note: It is reported that the accepted rate of chilled rollers in April 1953 was 72 per cent.

G. Production (1952)

1. Daily output

Since operation was conducted once every few days, the average daily volume was very small. However, the volume for one operation was 15 to 20 tons.

2. Annual output

Actual output of chilled casting in 1952 was 610 tons. The planned figure for 1953 is unknown, but the actual condition is that rapid development cannot be expected even from the technical standpoint. Sheet rolling in particular was still on trial operation.

3. Products

Chilled casting is divided into roller and machinery parts (utilized by the Workshop Department), but it mostly consisted of machinery parts when considering the weight. The actual output by products in 1952 is shown on Chart No 10-65.

4. Quality and specifications of products -- see section XI of this chapter for details

The specifications demand that the average hardness (shore) of the surface in the central part of the roller be 60 to 70 but the actual hardness is 55 to 60. Also, a chilled depth of 25 to 40 millimeters is specified, but it seemed that the actual depth is 20 to 25 millimeters.

5. Percentage of small bar rollers meeting specifications

In April 1953 about 72 per cent of the small bar rollers that have been produced were usable. Of the small bar rollers that have been produced in the period of six months up to April 1953, only 30 were accepted.

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VII. Foundry Department

A. Affiliation and Number of Plants

1. Affiliation

It is affiliated with the Production Office of the T'ai-Yuan Iron and Steel Works and is under the control of the assistant superintendent of production. However, in spring 1953, the foundry was still under construction and it is not verified as to whether the foundry department had been officially established at that time.

2. Number of plants

Foundry: one (under construction at the end of the first quarter of 1953)

B. History

Construction of the building commenced from autumn 1952 and the hammers were being installed in April 1953.

C. Equipment

1. Hammer: three to four

They were being installed in April 1953. Capacity and other details are unknown.

2. Boiler

The boiler was under construction in April 1953. Its capacity is unknown. It is believed to be used only for forging, but this has not been verified.

3. Heating furnace: one set (details unknown)

VIII. Workshop Department

A. Affiliation and Number of Plants

1. Affiliation

It is affiliated with the Production Office of the T'ai-Yuan Iron and Steel Works and is under the control of the assistant superintendent of production. The department is divided into the repair and manufacturing department and the electrical repair department.

2. Number of plants

a. Plant affiliated with the repair and manufacturing department

In autumn 1952, a new plant was completed and now there were two plants, including the plant which existed from the past. However, it is believed that the plants had been combined into one since then because the equipment from the old plant was being transferred to the new plant in spring 1953.

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Note: The workshops of the repair and manufacturing department were divided into the casting, forging and wood-pattern shops. In spring 1953, the overall finishing work was conducted in the old forging plant.

b. Plant affiliated with the electrical repair department: one plant

The building (Chilled Casting Department Plant No 2) of the chilled casting plant which had been expanded in late 1951 was being utilized (actual condition at the end of the first quarter of 1953).

B. History

1. There was no large operational equipment because most of the repair and manufacture of machinery were done at the T'ai-Yuan Central Machinery and Tool Plant (the present T'ai-Yuan Machinery and Tool Plant) during Japanese control before the war's end and during Chinese Nationalist control after the war's end.

2. After the Chinese Communists took control, a policy was established to fully equip the workshop department, and the expansion and equipping of workshops commenced fter 1952. Additional machinery were being installed in April 1953.

C. Construction of Plants

The new plant which was completed in autumn 1952 is four to five times larger than the old plant and there were opinions in some circles that it was too large. The floor space was 60 meters by 70 to 80 meters.

Expansion work such as that on the new plant may very well be indicative of the scale of the basic construction which will be conducted hereafter on the T'ai-Yuan Iron and Steel Works.

D. Equipment

The equipment of the old plant consisted of about 20 worn-out pieces of machinery such as lathes, etc. The equipment for the new plant were being installed in spring 1953. Therefore, the actual situation thereafter is unknown. However, there was nothing noteworthy in the situation up to that time.

E. Production

The newly constructed plant not only conducted repair work for the iron and steel works, but accepted work from the outside (other enterprises). At first, major repairs and repairing of precision machinery of the T'ai-Yuan Iron and Steel Works were being handled by the T'ai-Yuan Machinery and Tool Plant. However, the repairing capacity within the iron and steel works increased after the new plant went into operation, and in spring 1953, outside repair works were also being handled.

This tendency appears to be rather extreme and it can also be observed as a transitional phenomenon. However, the plant was actually producing its own bolts and dog spikes.

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IX. Refractory Material Department

A. Affiliation and Number of Plants

1. Affiliation

It is affiliated with the Production Office of the T'ai-Yuan Iron and Steel Works and is under the control of the assistant superintendent of production.

2. Number of plants -- unknown

B. History

The refractory material plant affiliated with this department was the former Northwest (T'AI-YUAN) Ceramics Plant which was constructed as one of the 36 plants under the Northwest Industrial Company before the war. After the Chinese Communists took control, it was incorporated into the T'ai-Yuan Iron and Steel Works as a plant of the Refractory Material Department where it still remains today.

C. Production and Demand for Refractory Material

1. Production

a. The peak output of firebrick by this plant during Japanese control before the war's end was 10,000 tons (daily output was 30 tons) in 1942.

b. The output during Chinese Nationalist control after the war's end was about 60 per cent of the peak established before the end of the war.

c. The output increased annually under Chinese Communist control, and the output reached 20,000 tons in 1952 and 30,000 tons in 1953.

d. The output was expected to be increased to 60,000 tons during the First Five-Year Plan.

2. Supply and demand

The supply and demand of firebrick at the T'ai-Yuan Iron and Steel Works is very well balanced and only those of special characteristics are purchased from the outside. Special refractory material consist of chrome brick which is imported from the USSR. The consumption of refactory materials by the iron and steel works is shown on Table No 1[illegible]-66.

X. Service Departments

A. Affiliation and Number of Plants

1. Affiliation

a. Electric Power Department

In the beginning, the power plant located within the iron and steel works was attached to the Electric Power Department of

the T'ai-Yuan Iron and Steel Works. However, following the reform of the Administrative structure in autumn 1952, the control was taken over by the T'ai-Yuan Electric Industry Bureau of the Ministry of Fuel Industry's Electric Industry Control Bureau (the present Ministry of Electric Power Industry), the state in which it remains today.

b. Gas and steam department

Details on its affiliation within the iron and steel works are unknown, but the iron and steel works did not have a specialized control organ such as a motive power department.

c. Waterworks department

This department is controlled by the Water Supply Control Section of the Track Department which is under the jurisdiction of the assistant superintendent of production.

d. Railway department

This department is under the control of the Transportation Department which is under the jurisdiction of the assistant superintendent of production.

2. Number of plants

a. Power plant: one

b. Boiler room: five (of which two were newly constructed in 1952 and 1953)

c. Water supply station: two

d. Pumping station: one

e. Locomotive shed: two (of which one was newly constructed in 1952)

B. Electric Power Department

1. History

a. At the time that the T'ai-Yuan Steel Mill, which was the predecessor of the present iron and steel works, came under the control of the Japanese Army in November 1937, a power plant (one 6,000-kilowatt generator) which was used exclusively by the steel mill was located within the mill compound.

b. Thereafter (in 1940) two 5,000-kilowatt generators were added to the power plant. These generators were made by the AEG Company of GERMANY.

c. In autumn 1953, under Chinese Communist control, the power plant within the iron and steel works was placed under the jurisdiction of the T'ai-Yuan Electric Industry Bureau of the North China Electric Industry Control Bureau of the Ministry of Fuel Industry, and the power plant was renamed the T'ai-Yuan Power Plant No 3.

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Note: 1. Beside the power plant of the iron and steel works (above-mentioned Power Plant No 3), two other power plants -- one within the city (Power Plant No 1) and the other in the northern part of the city (Power Plant No 2) -- were located in the T'ai-Yuan District at that time.

2. Following the establishment of the Ministry of Electric Power Industry on 31 Jul 55, the control of these power plants were taken over by the ministry. Thereafter, the official name of Power Plant No 3 became T'ai-Yuan Power Plant No 3 of the T'ai-Yuan Electric Industry Bureau, North China Electric Industry Control Bureau, Ministry of Electric Power Industry.

2. Equipment

a. Layout of equipment -- see Chart No 10-63

b. Main equipment -- see Table No 10-67

c. Removal and destruction of equipment

(1) In 1943, the pulverized coal plant which had been almost completed was destroyed by bombs during the first air raid (by P-51) on T'AI-YUAN and the plant had not been reconstructed by the end of April 1953.

(2) After the end of the war, there was no destruction of facilities during the civil war between the Chinese Nationalist and Chinese Communist forces.

(3) After the Chinese Communists took control and up to the end of April 1953, the antirevolutionary elements made two to three attempts to blow up the power plant. The devices to blow up the power plant were discovered before they went off, but none of the culprits were apprehended. After these incidents, the entrances to the power plant were strongly guarded and a barbed wire fence was erected around the power plant.

d. Strengthening and remodeling of equipment

(1) In mid-1952, the plan to construct a new power plant within the iron and steel works materialized and construction commenced from 24 Aug 52. The construction site was located on the southwestern side of Power Plant No 3. Since the construction site was low, it was necessary to fill the area with earth. Planned scale and facilities of the new power plant will be mentioned later.

(2) The smokestack of Power Plant No 3 projected out from the roof and the ash fallout was severe. Because of this fact, a scheme to send the smoke of this power plant by means of a blower to the smokestack of the power plant which had been enlarged before the war's end was being planned in April 1953.

3. Fuel

Blast furnace gas could be used as fuel. However, in spring 1953, conditions at the blast furnace plant did not permit the usage of blast furnace gas and the pulverized coal produced in HSI-SHAN was used instead as the source of heat for the boilers.

The volume of coal consumption was 2.0 to 2.5 kilograms per kilowatt-hour, which was not too favorable.

4. Electric power output

a. During Japanese control the power plant within the iron and steel works (the present Power Plant No 3) had two 5,000-kilowatt generators in operation at all times and the total power generation was 5,600 kilowatts (2,800 kilowatts per generator)

Note: It is observed that the 6,000-kilowatt generator (one) which had been installed in the past was used as a reserve at that time.

b. On the whole, the generating capacity and actual generation of the three power plants affiliated with the T'ai-Yuan Electric Industry Bureau are as follows:

(1) Power Plant No 1 (located within T'ai-Yuan)

(a) One 1,000-kilowatt (AEG) generator

(b) Capacity, 1,000 kilowatts

(2) Power Plant No 2 (located in the northern section of T'ai-Yuan):

(a) One 5,000-kilowatt (Siemens) generator

(b) One 4,000-kilowatt (Mitsubishi) generator

(c) One 3,000-kilowatt (AEG) generator

(d) One 1,000-kilowatt (SWITZERLAND, BURANBODE*) generator

(e) Capacity, 13,000 kilowatts

(3) Power Plant No 3 (located within the T'ai-Yuan Iron and Steel Works)

(a) Two 5,000-kilowatt (AEG) generator

(b) One 6,000-kilowatt (Siemens) generator

(c) Capacity, 16,000 kilowatts

(4) Total capacity: 30,000 kilowatts

(5) Actual generation: 25,000 kilowatts

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Note: It is believed that the power requirement of the T'ai-Yuan Iron and Steel Works at that time had reached 16,000 to 17,000 kilowatts. Therefore, it can also be assumed that some shortages occurred if power was supplied only by Power Plant No 3.

c. The planned total generation of the new power plant whose construction commenced on 24 Aug 52 was said to be 70,000 kilowatts. However, it is claimed that the generating capacity of the first period operation (operation was to commence on 28 Dec 54) of the above-mentioned power plant was to be 30,000 kilowatts (two 15,000-kilowatt generators).

d. Beside those belonging to the above-mentioned three powers plants, transmission lines were strung to link this works with the private generators (two 500-kilowatt generators) of the paper mill located in SHANG-LAN Ts'un (STC 0006/5695/2625). There was a plan to include the new power plant into the T'ai-Yuan electric power bloc, but because of the fact that aluminum wires were used, it seemed that all the former transmission lines (with the exception of the 35-kilowatt to 36-kilowatt lines of SHANG-LAN Ts'un) were to be changed.

C. Gas and Steam Department

1. Gas

Explanation will be omitted because its usage was limited to that already mentioned in the coking and pig-iron manufacturing departments.

2. Steam

a. Administrative setup of the boiler room and its functions

(1) Boiler Room No 1 (old installation)

This facility was used exclusively by the power plant within the iron and steel works. The iron and steel works relinquished its control after autumn 1952.

(2) Boiler Room No 2 (old installation)

This facility was attached to the coking plant. Six boilers were used by the coking plant, steel mill and medium bar mill.

(3) Boiler Room No 3 (old installation)

This facility was used exclusively by the blast furnace plant. It was located in the vicinity of the former small blast furnace. One boiler was in operation.

(4) Boiler Room No 4 (newly constructed in 1952)

This facility was used exclusively by the sheet mill. Two boilers were in operation.

(5) Boiler Room No 5 (newly constructed in 1953)

This facility was used exclusively by the foundry. Equipments were being installed in spring 1953.

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Note: Old installation refers to installation constructed before the Chinese Communist took control.

b. Equipment in the boiler room

(1) See Table No 10-68 for the equipment of Boiler Room No 2.

(2) Information concerning the equipment of Boiler Room No 4 were already mentioned under section V, F (sheet mill) of this chapter.

c. Raw material

(1) Source of coal supply

HSI-SHAN (15 kilometers west of T'AI-YUAN): utilized good quality bony coal which had been already washed.

(2) Composition of coal

(a) Fixed carbon: 60 to 65 per cent

(b) Volatile matters: 12 to 14 per cent

(c) Calorie: 6,500 to 7,000 kilocalories

D. Water Supply Department

1. History

a. During Japanese control, water was pumped up from deep wells and sent to the reservoir. From here the water was pumped (by 100 and several ten-horsepower pump of which there were several) to the water towers (two) and distributed throughout the iron and steel works for water supply and factory use.

b. After the Chinese Communists took control, water was obtained from the upper reaches of the FEN Ho. Consequently, two reservoirs and water pumping stations were newly constructed. Since the water of the FEN Ho is hard, it is not favorable for drinking and for use in boilers.

2. Source of water

a. The demand for water during Japanese control was not acute. Therefore, the necessary amount was pumped out from deep wells. However, there was a shortage of water after the Chinese Communists took control and water was obtained from the FEN Ho.

b. The flow of the river decreases during the dry period; therefore, there is a necessity to secure a water source if large-scale construction is to be carried out in the future.

3. Equipment and facilities

a. See Chart No 10-64 for water intake and water supplying facilities.

b. Details on facilities (at the end of the first quarter of 1953)

(1) Intake and conduit from the FEN Ho: one

This intake and conduit were dug after the Chinese Communists took control. They had to be dug anew after each flood and are therefore simply dug. The intake is located 100 meters downstream from the railway bridge of the line running to PAI-CHIA-CHUANG.

(2) Reservoir No 1

Its capacity unknown. It was constructed during Japanese control.

(3) Reservoirs No 2 and No 3

It was newly constructed after the Chinese Communists took control.

(4) Deep wells

They were dug during Japanese control. There are 13 wells and each well is 200 meters deep.

(5) Water towers

They were constructed during Japanese control. There are two towers and the capacity of each tower is 150 tons.

(6) Water pumps

There are several pumps and the motor is 100 and several ten horsepowers.

(7) Water circulating facility of Water Supply Stations No 1 and No 2: a complete set

They were increased after the Chinese Communists took control.

Note: There was a plan to convert the conduit into a concretewaterway.

4. Consumption of water

a. Industrial water (consumption during the integrated process of steel manufacturing)

(1) During Japanese control

The volume of water consumed was 70 to 100 tons for each ton of pig iron produced. Of the above volume, two-thirds was recovered water.

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(2) Under Chinese Communist control

The water intake volume is claimed to be 0.3 cubic meter per second. Therefore, the daily intake volume will amount to 29,920 tons. The planned pig-iron manufacturing volume for 1953 averages 500 tons a day. Therefore, the fresh water supply volume for a ton of pig iron produced amounts to about 52 tons. It can be assumed that the total volume of required water supply is about 150 tons including the volume of recovered water.

b. Water supply

The water pumped from the deep wells is used for drinking purposes.

Note: The underground water is of good quality and this can be more or less verified from the fact that the Japanese were using the water to brew good Japanese wine.

c. Drainage system

The main drainage pipe which was constructed in 1939 (Shansi Industrial Co, Ltd era) at a cost of 60,000 yen by the construction department of the Fu-ch'ang Company of DAIREN (38°56'N) was being used.

The drainage water accumulates in a pond located south of the iron and steel works, and then discharged into the FEN Ho.

E. Railroad Department

1. Railroad siding

a. The railroad sidings running into the compound of the iron and steel works consist mainly of three tracks which could be used as standard or narrow gauge lines.

b. During Japanese control, a standard-gauge siding had been laid in from HUANG-HOU-YUAN (37°56'N 112°36'E) in the north and a narrow-gauge siding had been laid in from the T'ai-Yuan North Station in the south. However, in order to shorten the traveling distance, the Hsin-ch'eng Station was constructed after the Chinese Communists took control and a standard-gauge line had been laid in from this point.

c. Thereafter, following the expansion of the plant site, the number of new lines was also increased, but the length of the extension is unknown.

d. Lengths of the private lines outside the iron and steel works are as follows:

(1) Northern part: about 1.5 kilometers to HSIN-CH'ENG (standard-gauge line)

(2) Southern part: about seven kilometers to T'ai-Yuan North Station (narrow-gauge line)

2. Supplying of materials

Rails (17 kilograms; length, about 10 meters), dog spikes and fish plates are supplied by the works. Ties (willow wood) are purchased from the outside.

3. Rolling stock

a. Locomotive maintenance

There were about 20 locomotives in April 1953. It seemed that these locomotives were borrowed from the T'ai-Yuan Railway Control Bureau. Coal tenders are attached to all locomotives. Standard-gauge locomotives weigh from 20 to 30 tons and narrow-gauge locomotives weigh 12 to 13 tons. These locomotives are old models such as the MOGA* and TEHO*.

There are more standard-gauge locomotives than narrow-gauge locomotives. Furthermore, there is one 5-ton locomotive crane operating at the sheet mill.

Note: There were only about 10 locomotives during Japanese control. Moreover, these locomotives broke down continuously and replacements were requested to the Japanese Army and the North China Transportation Company but aid was difficult to obtain.

b. Operation of locomotives

About 20 locomotives were in operation every day in spring 1953.

c. Locomotive repairs

Major repairs were conducted at the Railway Factory and minor repairs were conducted at the roundhouse within the iron and steel works.

d. Roundhouse

There is an old roundhouse and a new roundhouse. The new roundhouse was constructed in 1952. It is a wooden truss structure, and could accommodate two rows of locomotives.

e. Freight cars

Freight cars consisted mostly of two types -- 15-ton freight cars and 20-ton freight cars. There were also such special cars as hot-metal cars. There were no freight cars larger than 50-ton freight cars.

The number of freight cars increased after the Chinese Communists took control, but the exact figure is unknown. Ordinary freight cars were mostly gondola cars. There were two 30-ton hot-metal cars.

f. Electric cars

In spring 1953, the electrification of transportation facilities was still in the infant stage because of the electric power situation.

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The electric cars for hauling blast furnace charging material to the ore bins were constructed at the iron and steel works in early 1951. The dead weight of an electric car was about two tons. Coal cars was attached to these electric cars. There were three electric cars in April 1953.

In addition, there were coke furnace raw material charging electric cars and coke quenching and transporting cars.

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4. Amount of material transported

The amount of material transported daily was 6.83 times the amount of pig iron produced. Of this transported amount, ore, including limestone, constituted 2.5 times the pig iron output; coal used as raw material (for coke) constituted 1.3 times the pig iron output; and pig iron, steel ingot and rolled products each constituted the same amount as the pig iron output. Including other transported material, the total amount of material transported was about eight times the amount of pig iron produced. Therefore, for each ton of pig iron produced, the amount of material transported calculated to be eight tons.

The amount of freight moved within the plant in spring 1953 was about 4,000 tons based on the daily pig-iron output of 500 tons and was about 1,200,000 tons under the annual production plan of 150,000 tons. However, since the transportation distance was unknown, it was impossible to calculate the ton-kilometer.

XI. Testing and Inspection Department

A. Affiliation and Organ in Charge

1. Affiliation

This department is attached to the Production Office of the T'ai-yuan Iron and Steel Works.

2. Organ in charge

Testing and inspection are carried out by the technical supervision section of the Production Office under the guidance of the assistant superintendent for production. Since the inspectors attached to this section are held responsible whenever any product not meeting specifications is found among the finished products, inspections are conducted very thoroughly by the inspectors.

Operational setup of the technical supervision section is shown on Chart No 10-65.

B. Equipment

1. Physical testing equipment -- see Table No 10-69.

2. Chemical testing equipment: details unknown

C. Testing Method

1. Type and method of testing and inspection

a. Complete test

Physical test, chemical analysis, surface inspection, and internal inspection are conducted on samples of steel ingot, coke, and pig iron which are picked at random.

b. Simple test

As simple tests, analysis of materials at the furnace front and surface inspection (both carried out at the worksite) are mainly conducted. During these tests, special attention is given to the assaying of ore slag and steel slag.

c. Testing method

The test was conducted under the ASME method, but since March 1953, it seems that the Soviet method is being utilized. The Soviet method, however, is said to give the impression that it is an adaptation of the ASME method.

2. Steel ingot testing method

a. Number of tests

A complete test on steel ingot is always made by extracting three steel ingot from each heat.

b. Method of extracting samples for testing

Nine sample pieces for testing are extracted from each charge of the open-hearth furnace. In extracting sample pieces, three steel ingots are extracted from the five molds in one pit -- one each from the three rows formed by the No 1, No 2 and No 3, and No 5 molds. Each steel ingot is test-rolled and cut into three sections (top, middle and tail) and three test pieces are obtained.

c. Structural test

This test is also known as the "Acid-soaking test". After the sample is pickled with sulphuric acid, it is examined with the naked eye. At the same time, the structure, impurities, and air-bubbles of the sample are examined through a microscope.

The use of steel ingot which is liable to expose faults on the surface during rolling is prohibited. In case the product does not meet specifications, the entire tapped amount from the furnace must be discarded.

d. Classification of inspection according to specifications

Test-rolled steel ingot which passes the pickling test is then given complete physical, chemical analysis and microfilm tests.

Only on special occasions are physical test and chemical test both conducted. In most cases, either one of these tests is requested for "A" steel and "B" steel. "A" steel is classified through physical test, whereas "B" steel is mainly classified in proportion to the amount of carbon content ascertained through chemical analysis.

e.

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e. Physical test

Testing of ordinary steel is principally for tensile strength, hardness, and resistance to bending. However, heat treatment and metallographical tests are made on high quality steel produced by electric furnaces. The types of tests which are conducted at this works are as follows:

(1) Tensile strength test

Test is made with the Amsler-type tension tester

(2) Hardness test

The hardness of steel is measured by the Brinell (HB), Rockwell (HR), and Shore (HS) hardness testers, and the hardness is determined by the statistics of these three tests.

(3) Impact test

With the use of the impact tester, the sample is tested by a gravitational force of 25 kilograms from various heights to measure its resistance.

(4) Cold bending test

This test is also called a bending test. It measures the resistance against the bending force.

(5) Crushing test

This test is a cross-sectional test of the round bar. It measures the resistance of a fixed measured area when crushing force is applied.

(6) Fatigue test

This test measures the degree of fatigue of the steel through the application of various dynamic resistances.

f. Chemical analysis

The actual condition of chemical analysis could not be obtained.

3. Utilization of test results

Since steel is being tested by taking test samples each time an open-hearth furnace is tapped, the test results of each of the finished products are always available. Therefore, in the event of a complaint about the product, an answer to the complaint can always be made by checking the test results of the said product.

4. Inspection of rolled steel products

a. Inspection of medium and small bar products

(1) Place of inspection

The inspectors determine whether the products meet or do not meet specifications at the outdoor storage yard.

(2) Change in inspection policy

In the early part of Chinese Communist control, emphasis had been placed on mass production based on quantity. Therefore, even articles which were believed to be not up to standard were accepted, but since late 1951 inspections were strictly carried out in a move to improve the quality of products.

(3) Strictness of inspection according to types of products

(a) Steel bloom -- lax

(b) Sheet bar -- strict

(c) Material for machinery and parts -- strict

(d) Concrete bar

Since this item is for construction purposes, even products of inferior quality are overlooked at times.

(e) Wire rod

Conditions of this item is somewhat similar to the above item. As long as the wire rod does not have any fin, even those not up to standard can be used as construction material.

b. Inspection of sheet products

(1) Exterior inspection

According to the external appearance of the products, the sheet is classified into Grade A and Grade B products.

(2) Physical inspection (mechanical quality test)

(a) Method of inspection

The method of inspection is based on the Ericksen test (depression test). A steel plate is extracted from the top, middle and lower layers of the pile of annealed steel plates. These steel plates are

pressed with a tool having a 20-millimeter diameter spherical surface to test the extent of annealing. (See Chart No 10-66)

(b) Products not meeting specifications: placed with Grade B products

(c) Place where test is conducted: the technical supervision section laboratory

5. Electric furnace test

Details of this test are unknown. However, the test is not limited to a test of the product, and operational tests are also conducted. Electric testing of silicon steel in particular is emphasized.

Note: It is reported that silicon steel testing equipment, which can be found only in one or two places besides the Yawata Iron Works in JAPAN, is established in the T'ai-yuan Iron and Steel Works.

6. Chilled roll testing

Chilled roll testing is being conducted, but the details are unknown.

7. Coke testing

Chemical analysis and physical tests of coke (shutter test and drum test) are made, and coke which contains more than 13 per cent ash is rejected. When any coke is found to be unfit for use, the entire output from the coke oven concerned is prohibited from being charged into the blast furnace.

8. Analysis of other raw materials

Analysis of other materials is being made, but details are unknown.

9. Points emphasized in the testing of products

In general, emphasis in testing has been placed on the maintenance of existing standard for products which has been produced at this works from the past, and on the improvement of operational method and the raising of the quality for new products.

D. Replenishment of Equipment and Supply

Necessary equipment used in testing are purchased without regard to cost whenever a requisition with attached estimates are made. Gradually but surely, the requested equipment are being purchased.

Note: In autumn 1952, the T'ai-yuan Iron and Steel Works received orders from the Central Government's Ministry of Heavy Industry to come and inspect the supersonic wave tester which had arrived in PEKING. Thus Chinese technicians from this plant were sent

to PEKING. It is not known whether this equipment was assigned to the T'ai-yuan Iron and Steel Works or not. It seems that this equipment was made in EAST GERMANY and not in the USSR. The capacity of the equipment and other details are unknown.

The lack of equipment felt most keenly at the T'ai-yuan Iron and Steel Works until spring 1953 was that of research materials. Particularly, the lack of special paper for polishing test samples impeded operations. This paper is known as emery paper and its extremely fine granularity ranging from No 1 and No 0 to No 5/0 makes it suitable for polishing metalloscope test samples. US made paper is the best, and even British-made paper is said to be inadequate in quality.

E. Specification

1. Establishment of a nationwide "List of Tentative Standards for Industrial Products".

To unify the standard of iron and steel products throughout the country, the "List of Tentative Standards for Industrial Products" was established by the Central Government in 1951. This list was delivered to the T'ai-yuan Iron and Steel Works from the Ministry of Heavy Industry's Iron and Steel Industry Control Bureau.

It seems that this list has been prepared in conformity with Soviet standards, but in content it is almost the same as the standards used during Japanese control. A list of specifications for products of this plant was established in conformity with the above list.

Note: There was no special need for establishing a list during Japanese control because Japanese specifications were applied.

2. "List of Tentative Standards of Industrial Products" of the T'ai-yuan Iron and Steel Works

a. Time of establishment: 1951

b. For details, see Table No 10-70 to Table No 10-86.

Note: There is no entry concerning sheet metal in this list.

XII. Basic Construction

A. Two Phases

In the stage following Chinese Communist control and up to the present time, the basic construction of various facilities at this plant was conducted under two phases. The first-phase basic construction was aimed at the establishment of an integrated process of steel manufacture with an annual output of 200,000 tons of pig iron and 150,000 tons of steel ingots. The second-phase basic construction was aimed at the expansion and consolidation of the integrated process of steel manufacture with an annual output of 300,000 tons of pig iron and 250,000 tons of steel ingots.

The accurate time classification of these two phases is unknown. but it is presumed that the first-phase basic construction was conducted from early 1950 to late 1952 and that the second-phase basic construction was conducted from the beginning of the First Five-Year Plan in January 1953. The actual field observation up to the end of the first quarter of 1953 revealed that this presumption is roughly correct.

On the whole, the first-phase basic construction corresponds to the production recovery stage of this works. The construction work mainly consisted of reconstruction and restoration of facilities, but it also included some new construction work. The second-phase basic construction corresponds to the large-scale national construction period. The construction work mainly consisted of new construction work.

At the beginning, the basic construction work at this iron and steel works was apparently designated as one of the most important projects of the basic construction works conducted at the state-operated iron and steel enterprises throughout CHINA. Following the establishment of the Chinese Communist regime until late 1952 (mainly during the first-phase basic construction), this iron and steel works apparently received preferential treatment from the Central Government in such fields as technical matters, labor, materials, and funds as the enterprise with the highest priority for rehabilitation and construction in CHINA proper (excluding the Northeast Area -- MANCHURIA).

Note: In early 1951, the staff members of this works told the workers that the Central Government had given top priority to the basic construction work of the T'ai-yuan Iron and Steel Works and also in the distribution of funds. This fact, was also printed in the local newspapers at that time.

Basically speaking, such priority is believed to be based on the results of production, various established production facilities, and the location of the works. However, with the intervention of the Chinese Communist Army in the Korean War since late 1950, emphasis placed on this priority increased. The foregoing peculiarity is rather clearly revealed in the transfer of the iron and steel industry facilities from the coastal areas such as TIENTSIN and SHANGHAI, and machinery from the Northeast Area (particularly from SHEN-YANG) to this works since 1951.

However, the foregoing trend reveals that rather large changes are being made since the start of the second-phase basic construction (that is, the beginning of the First Five-Year Plan and almost the conclusion of the Korean War). At this stage, the basic construction work of this iron and steel works cannot necessarily be regarded as the biggest task in basic construction of the iron and steel industry in CHINA proper. As the task of establishing new integrated iron and steel centers at PAO-T'OU and WU-HAN (including TA-YEH) comes to the fore, it can be considered that the basic construction of this works will somewhat drop in importance. However, it can be said that from the standpoint of its scale and content, the basic construction of this works will still occupy an important position in the basic construction of the iron and steel industry in North CHINA.

B. Delay in Construction and Its Reasons

From the standpoint of actual work progress, the basic construction of this works is believed to be somewhat behind schedule. It is reported that late 1952 was set as the target date for completion of the

first-phase basic construction, but actually the work had lasted until autumn 1953. It is also reported that the second-phase basic construction was expected to begin simultaneously with the commencement of the First Five-Year Plan. According to estimation made in spring 1953 -- the first year of the five-year plan -- it was believed that the work would not enter its full stage before the latter half of the five-year plan (at least after autumn 1954).

Only conditions of various projects belonging mainly to the first-phase basic construction have been clarified in this survey. However, in this respect, it can be said that the construction work has been delayed. The following conditions can be pointed out as reasons for this delay.

1. Insufficient Soviet Aid

Soviet aid toward the first-phase basic construction was very limited in manpower and material. At this stage, Soviet technicians were not permanently stationed at this works. Technical assistance was mostly given through books on designing, and in pointing out defects of incomplete designs. There was virtually no direct concrete technical guidance. Particularly, the supply of equipment and material from the USSR was very unsatisfactory. Therefore, at this stage, the basic construction of this works was dependent upon the technical guidance of detained Japanese, and both equipment and materials had to be provided by appropriating already-established facilities in CHINA and by domestic products which were inadequate in quality and quantity. The foregoing reason is said to be one of the main factors in delaying the first-phase basic construction.

Note: The second-phase basic construction work is reported to be mainly relying on the so-called 141 projects which are to receive Soviet aid. According to the period of the final decision made on this aid program, it can be said that Soviet aid during the first-phase basic construction was insignificant and conservative. In view of the strict planned economy system in the USSR, it is needless to say that it would be very difficult for the USSR to carry out emergency production and supply of ordered goods which differ in design and standards or goods on order which are not included in the plan.

2. Effect of the Korean War

The first-phase basic construction was conducted during the peak of the Korean War. Thus, it cannot be denied that this situation contributed to the delay in construction work. For instance, the laying of bricks in coke oven No 2 of this works began in April 1950 and was completed in October 1950 (immediately prior to the Chinese Communist intervention in the Korean War). In spite of the fact that the groundwork of the coal washing plant were forcibly conducted in winter 1950, the construction of the coal washing facilities and the suction gas scrubber was held up. In September 1952, they finally commenced operation. It is reported that the foregoing delay was mainly due to the influence of the war.

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C. Principal Construction Projects

1. Construction projects classified as improvements

a. Improvement of blast furnace and mechanization of at attached equipment

(1) Construction details: improvement of blast furnace, increasing of furnace capacity, and establishment of new ore crushing equipment, raw material transporting equipment, and ore storage bins.

(2) Construction dates: work started in 1950 and completed in 1951

b. Improvement of open-hearth furnaces

(1) Construction details: two 40-ton open-hearth furnaces converted into two 50-ton open-hearth furnaces; new accessory equipment installed

(2) Construction date: completed in spring 1952.

c. Separation and independence of small bar mill

(1) Construction details: various projects (installation of new motors, reinforcement of heating furnace, change in layout of equipment) to separate the small bar mill from the medium bar mill

(2) Construction date: completed in late 1952

d. Expansion of the medium bar mill

(1) Construction details: increase in heating equipment, steel ingot conveying equipment, and product straightening equipment.

(2) Construction date: completed in autumn 1952

e. Transfer and installation of sheet rolling equipment

(1) Construction details: two sets transferred from SHANGHAI and installed

(2) Construction date: work started in autumn 1951 and completed in January 1953.

Note: New plating equipment was expected to be installed, but the work had not as yet started in late April 1953. Three plating equipment, each capable of plating 10,000 sheets of No 29 gauge steel plates daily, were expected to be installed. Thus the planned total daily output was 30,000 sheets weighing 115.5 tons.

f. Transfer and installation of electric furnace

(1) Construction details: two 3-ton electric furnaces transferred from the Northeast Area and installed; two 8-ton electric furnaces transferred from T'ANG-SHAN and installed

(2) Construction date: installation of the electric furnaces transferred from the Northeast Area completed in autumn 1952; electric furnaces transferred from T'ANG-SHAN expected to have been installed in autumn 1953.

g. Consolidation of equipment for mixing blast-furnace gas and coke gas

(1) Construction details: increase in the number of gas pipes and gas pressure (mainly for supplying gas to rolling mill)

(2) Construction date: was under construction in spring 1953

h. Expansion of transportation facilities: establishment of additional railroad sidings and increase in the number of locomotives and rolling stocks

i. Expansion of equipment for the manufacturing of refractory materials

(1) Construction details: improvement of equipment (Annual production, 20,000 tons)

(2) Construction date: completed in 1952.

2. New construction projects

a. Installation of blast furnace No 3 (planned)

(1) Construction details: installation of two 250-ton blast furnaces or one 500-ton blast furnace being studied; strong possibility for the installation of the two 250-ton blast furnaces

(2) Construction date: part of the second-phase basic construction; the project not as yet started in spring 1953

b. Installation of coke ovens and accessory equipment

(1) Coke oven No 2

(a) Construction details: installation of coke oven, coal washing equipment, and suction gas scrubber

(b) Construction date: work started in April 1950 and completed in September 1952

(2) Coke oven No 3 (planned)

(a) Construction details: installation of coke oven unit (number of ovens, 30 to 50), coal washer (treating capacity, 60 to 80 tons an hour), coal tower No 2, portable quenching equipment, and suction gas scrubber

(b) Construction date: part of the second-phase basic construction; project not as yet started in spring 1953, but since coke oven No 1 has become old and decrepit the work commencement date seems to have been advanced.

(3) Coal storage bin and bridge crane (planned)

(a) Construction details: construction of coal storage bin (reinforced concrete structure; capacity, 10,000 to 15,000 tons) and a bridge crane (capacity, 100 tons an hour).

(b) Construction date: belongs to the second-phase basic construction; project not as yet started in spring 1953.

c. Construction (planned) of by-products plant: part of the second-phase basic construction, but the project not as yet started in spring 1953; however, starting date of the construction believed to have been advanced because the capacity of present by-products plants (facility to cope with coke oven No 1) was inadequate.

d. Additional construction on the open-hearth furnace plant

(1) One 50-ton open-hearth furnace (including attached equipment): construction completed in September 1952

(2) Two 50-ton open-hearth furnaces (including attached equipment): the building to house the furnaces completed but the furnaces were still under construction in spring 1953; part of the second-phase basic construction

(3) Construction of a 300-ton mixer: part of the second-phase basic construction; construction of this mixer being discussed from 1950 but not as yet started in spring 1953

(4) Construction of ingot-mold cooling and cleaning facility and building (construction was being planned in spring 1953)

The purpose of this construction was to beautify the surface of the steel ingot and lengthen the life span of the ingot mold by perfecting a method to clean the ingot mold, which was not thoroughly cleaned in the past. The plan was to use part of the building for brick storage. This building is eight meters wide and 195 meters long, and the area covers 1,560 cubic meters.

e. Additional construction (planned) for medium bar mill and small bar mill

This plan was just a rumor and there is no verification. One set was planned for each mill. The date of construction is unknown.

f. Construction of forging facility

The building (including the boiler building) was completed in spring 1953 and equipment were being installed at that time.

g. Construction of workshop plant

A building five to six times larger than the existing workshop plant was completed in spring 1953.

h. Construction of reverberatory furnace

(1) Construction details: one 15-ton reverberatory furnace equipped with roller casting facilities

(2) Construction date: completed in late 1951

i. Construction (planned) of refractory material facility

(1) Construction details: a plan for a new facility with a production capacity of 40,000 tons a year

(2) Construction date: part of the second-phase basic construction; expected to be completed in 1955

j. Construction of power plant (under construction)

(1) Construction details: construction of a new 70,000-kilowatt power plant; construction site located on the west bank of the FEN Ho (12 kilometers from SHOU-I-MEN /STC 7445/5030/7024/); one of the 141 item of Soviet aid.

(2) Construction date: construction commenced on 24 Oct 52; first-phase of construction expected to be completed by the end of 1954 with generating capacity of 30,000 kilowatts; entire construction expected to be completed in 1957 with generating capacity of 70,000 kilowatts.

k. Construction (planned) of main office building for the iron and steel works

(1) Construction details: ferroconcrete building with three to four stories

(2) Construction date: initially planned for the first-phase basic construction, but was put off because of priority given to construction of welfare facilities; not as yet started in April 1953

Note: The building (two-story ferroconcrete building) housing the technical supervision section was completed in early 1952.

l. Construction of welfare facilities

(1) Housing construction

Since spring 1952, a large company-housing area was under construction in the district lying on the east side of Hsin-cheng Station. In late 1952, houses for 1,000 families were completed. In addition, ground clearing work was in progress in spring 1953 to expand this housing area.

Note: In addition to the above housing project, some houses for high-ranking officials (also called the Hua-yuan Housing Area) were being constructed, but the construction stopped because of criticisms from the workers.

(2) Construction of hospital, schools, cooperative, etc.

In May 1952, a two-story high workers' hospital, workers' children's school, cooperative, nursery, etc were newly constructed in the above mentioned housing area.

(3) Recreational facilities

From late 1952 to spring 1953, a workers' playground, a workers' garden and a cultural theater were constructed alongside the above mentioned housing area. The capacity of the cultural theater is 700 to 800 persons. A two-story brick building housing various types of stores with modern facilities was constructed around the cultural theater by the Shansi Province People's Government.

D. Expansion of Plant Area

Following the planning and execution of the above mentioned basic construction, the plant area and attached areas were being expanded at an epoch-making pace. The plant area at the war's end in 1945 was over 80,000 tsubo. The area suddenly increased to over 300,000 tsubo after 1951. It is observed that the total area will

reach close to 1,000,000 tsubo if the plant site and attached areas, housing area, schools, hospital and areas for other facilities are all included in the calculation of the actual survey.

E. Organization in Charge of Basic Construction and Its Function and Personnel

1. Establishment of the organization

a. The Construction Engineering Office was created in the iron and steel works in February 1950. The technicians attached to the various offices and departments already established were temporarily assigned to handle the basic construction works of this engineering office in addition to their own duties.

b. From late 1950 to late 1951, these technicians (Japanese and Chinese) holding two positions were gradually transferred from the Production Department and placed under the exclusive jurisdiction of the engineering office.

c. The Basic Construction Office was created in autumn 1952. The Construction Engineering Office was dissolved to form a larger organ and its personnel was transferred to the Basic Construction Office. Thereafter, the basic construction projects of the iron and steel works were placed under the jurisdiction of the Basic Construction Office.

d. Taking advantage of this change, all the privately-operated civil engineering and construction companies which had been sub-contractors in the basic construction projects of the iron and steel works in the past were taken over as state-operated engineering companies under the exclusive jurisdiction of the iron and steel works.

2. Functions of Basic Construction Office

a. In the execution of its duties, the Basic Construction Office received direct guidance from the Basic Construction Office of the Iron and Steel Industry Control Bureau of the Ministry of Heavy Industry.

b. The functions of the Basic Construction Office was sharply differentiated from the general production functions (including Workshop Department). Their respective functions, personnel and accounting were distinctly divided.

c. The functions of the Basic Construction Office were the planning, designing and execution of restoration, reconstruction and new construction work on the facilities stipulated in the temporary management setup on basic construction, and the supervision, disposal and utilization of labor, materials and funds connected with the above mentioned functions.

d. All functions in basic construction were planned and executed according to the national plan. Basic construction plans consisted of those drafted and decided upon according to the idea of the Central Government, and those planned and executed within the limits authorized by the Central Government according to the request of the iron and steel works. In both cases, the concrete groundwork of the plans was formed through the cooperation of the Basic Construction Office and the Planning Office of the iron and steel works.

e. On the procedure for drafting plans, the Planning Office of the iron and steel works first draws up an outline of the groundwork according to the instruction of the Central Government or according to the ideas of the iron and steel works, and then forward this outline to the Basic Construction Office. Based on this outline, the Basic Construction Office conducts discussions and negotiations with the Production Department and compile the draft into a concrete basic construction plan for the fiscal year, and present it to the Basic Construction Office of the Iron and Steel Industry Control Bureau of the Ministry of Heavy Industry along with the necessary budget. The Basic construction Office of the Ministry of Heavy Industry will conduct a collective comprehensive study on the fiscal year plans and budgets submitted from the construction offices of the various affiliated plants and then presents these plans and budgets to the National Planning Committee. The National Planning Committee adopts and includes these plans and budgets as a part of the National Comprehensive Program, and those that are approved at the State Council becomes the official basic construction plans. The basic construction plan which has been decided upon through the procedure mentioned above is returned to the Basic Construction Office of the iron and steel works via the Ministry of Heavy Industry and put into execution as a state directed plan. The state directed plan has the same authority as a law and the Basic Construction Office must guarantee correct execution of this plan under strict responsibility.

3. Financial planning for basic constructions

a. The financial planning for basic construction is compiled according to the groundwork of the abovementioned basic construction budget. The procedure of this compilation is parallel to the procedure for compiling the basic construction plan.

b. Based on the financial planning for basic construction, the basic construction investment amount for each state plant will be decided upon. A plant will be furnished with the necessary funds for basic construction from the state bank (People's bank or an authorized long-term investment bank) within the limits of the investment amount.

Note: 1. Normally around August of each year, the Central Government instructs a plant to submit an outline of the basic construction plan (groundwork which becomes the essential features in compiling a plan) and the basic figures for the corresponding investment amount (basic construction investment control figure) for the next fiscal year. A plant draws up a basic construction plan and budget for the next fiscal year based on this planned outline and investment control figure, and present it to the Central Government.

2. However, all the important basic construction projects of the iron and steel works in the 1952 and 1953 fiscal years were placed under unlimited budget. In an unlimited budget, the investment amount was not limited and only the necessary amount was invested. There is no concrete fact as to why the foregoing measure was adopted during the 1952 and 1953 fiscal years. It could be judged that the construction projects had been extremely important for the state or there was no way of planning an accurate financial control.

4. Recruitment and distribution of basic construction workers

a. Among the basic construction workers, the greatest shortage was on designers. Based on the policy of putting the right man in the right place, the designers, aside from those that were selected from the Production Departments attached to the iron and steel works, were supplemented through transfers from AN-SHAN, CHUNGKING, SHEN-YANG, and SHANGHAI.

b. Even the supervisors of the Basic Construction Department were made up of personnel that were dispatched from AN-SHAN and PEN-CH'I and those that were selected from the small private factories. It seemed that the personnel were brought in from various areas at various times whenever necessary.

c. On the other hand, personnel of the Basic Construction Department of the iron and steel works was frequently transferred or dispatched to assist in other plants. For example, in late 1952 about half of the basic construction workers of the iron and steel works were transferred to the Shih-ching-shan Iron and Steel Works following the completion of the first-phase basic construction. Furthermore, in April 1954, the personnel was dispatched to help out at the Ta-yeh Steel Works.

d. In short, it seemed that the personnel of the Basic Construction Department was controlled by the Central Government (Basic Construction Office of the Iron and Steel Industry Control Bureau of the Ministry of Heavy Industry). Based on the national basic construction worker's supply and demand program on state-operated iron and steel enterprises, it is observed that the personnel were frequently moved in sequence to strategic points according to their importance.

Note: The People's Daily issue of 23 Apr 54 reported on a plan which calls for basic construction workers of this iron and steel works who had completed the required construction work to be gradually distributed to the various basic construction sites such as TA-YEH, AN-SHAN, CHUNGKING, SHIH-CHING-SHAN, MA-AN-SHAN, PEN-CH'I and URUMCHI (43°48'N 87°36'E). In April 1954, a basic construction unit of the iron and steel works composed of over 1,900 workers was dispatched to TA-YEH. This was a large group headed by the accountant and section chiefs of an engineering company, chief of a construction district, engineers, technicians and technical staff members, and 37 different types of workers such as electric welders, rivet workers, furnace construction workers and crane operators.

5. Designing technique

Owing to the previously mentioned reasons, nearly all of the designs for the various constructions connected with the first-phase basic construction were made by the detained Japanese technicians. The constructions carried out during this phase were conducted according to the urgent necessity to rehabilitate production. In general, rough and ready methods were enforced, and plans and designs used were mostly those that had been drawn up during Japanese control before the end of the war. At the same time, facilities and designs of other plants were adopted as they were even for constructions requiring new planning and designing, and most of the construction projects were conducted by diverting the already existing plans and designs.

For example, in the construction of the new Coking Plant No 2, the plans and designs drafted under Japanese control were adopted in full for putting up the coke oven and attached gas washing facilities. Consequently, the capacity, model and productive capacity of the furnace were similar to that of the formerly constructed furnace, and hardly any progress or improvement was observed on the designing technique.

However, in the construction of the new Coal Washing Plant No 2, the Baum model was changed to that of the Jigger model because the efficiency of the already existing facility was poor. Furthermore, in consideration of the future construction of Coking Plant No 3, the existing foundation was removed and a great change was made on its location. However, even on the design of this Baum model, the blueprints of the Yawata Ironworks which were left behind at SHIH-CHING-SHAN were adopted. Therefore, in a true sense, it cannot be called a new design.

Even at that time, Soviet techniques were widely propagated as advanced techniques. However, up to the end of the first quarter of 1953, these techniques were used only as reference for local designing by the iron and steel works and they were not adopted in full. These spot utilizations were carried out on a limited scale as reference to the present compilation of blueprints of the USSR.

6. Required equipment and supplies

a. Owing to reasons previously stated, materials existing within the country were utilized as much as possible as equipment and supplies necessary for the first-phase basic construction. Shortages were covered by domestic products in spite of technical and financial difficulties, and the policy was to import only necessary machinery from foreign countries when self-supply was absolutely impossible.

b. Concerning the utilization of facilities existing within the country, emphasis was mostly placed on transferring prewar facilities existing in the coastal districts. Also, efforts were made to utilize unused facilities (unused facilities transferred from PEN-CH'I immediately before the war's end were installed in T'AI-YUAN).

c. Domestic products that were utilized consisted mostly of items produced by the machinery plants in SHANGHAI and TIENTSIN. Materials produced within the iron and steel works were manufactured in spite of the lack of experience and financial difficulties. Even when placing an order outside the iron and steel works, plants other than specialized plants were mobilized to produce the necessary machinery. These productions were conducted at an unexpectedly high tempo but there were various defects in the quality. The efficiency in the production of motors was poor. In the manufacture of machinery, there were numerous material wastes and the power need was more than what was actually required. These defects fully exposed the low standard of the designing technique.

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d. The shortage of supplies could not be met by means of legal importations alone. On roofing sheets, Japanese products were smuggled in from 1951 to 1952 to partially supplement the shortage.

e. However, these conditions were gradually alleviated from late 1952. Thereafter, various required supplies began to come in regularly from EAST GERMANY, CZECHOSLOVAKIA and GREAT BRITAIN. In general, it is observed that the material and technical assistances of the various countries of the communist bloc became somewhat active from November 1952.

7. Morale of workers

In spite of the various defects and shortages mentioned above, the workers of the iron and steel works exhibited extraordinary enthusiasm and positiveness toward the construction projects. Even after the newly constructed facilities had started production, studies on the facilities were still conducted very earnestly.

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XIII. Management and Other Affairs

A. Management

See Chart No 10-67

1. Key personnel

Only informations verified through investigations will be mentioned.

a. Superintendent of the iron and steel works (one)

(1) First superintendent of the iron and steel works -- LI Fei-p'ing (STC 2621/2431/1627) (Party member)

He was appointed the first superintendent of the iron and steel works in September 1949. His previous position was superintendent of the T'ang-shan Steel Works. In summer 1952, he was transferred to become the chief (some sources say that he became an assistant chief) of the Basic Construction Office of the Iron and Steel Industry Control Bureau of the Ministry of Heavy Industry.

(2) Second superintendent -- PAI Hao (STC 4101/3185) (Party member)

His previous position was first assistant superintendent of the iron and steel works, and concurrently chief of administration. In spring 1952, he filled the additional position of assistant superintendent in charge of basic construction following the removal of LI Shu-jen (STC 2621/2885/0086), assistant superintendent in charge of basic construction, who was removed as a result of the Three-anti Movement. In summer of the same year, PAI was appointed superintendent of the iron and steel works following the transfer of the previous superintendent. PAI was still superintendent at the end of the first quarter of 1953.

b. Assistant superintendents (seven) of the iron and steel works

(1) Each assistant superintendent was concurrently in charge of an office; such as the assistant superintendent in charge of administration and the assistant superintendent in charge of production. These assistant superintendents were addressed as mentioned above.

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(2) At the end of the first quarter of 1953, the first assistant superintendent (TING Shao [STC 1353/4801], about 50 years old) was concurrently in charge of the Production Office and was known as the assistant superintendent in charge of production. He was a technician who had studied in the UNITED STATES and he was frequently criticized that his thoughts were backward.

(3) At the end of the first quarter of 1953, the assistant superintendent in charge of production and the assistant superintendent in charge of basic construction were the only non-Party members among the superintendent and seven assistant superintendents.

(4) In the same period, the superintendent of the iron and steel works concurrently filled the position of assistant superintendent in charge of planning. In the same period, the assistant superintendent in charge of accounting was a certain PAI (STC 4101).

2. Party committee of the iron and steel works

The official name was the T'ai-Yuan Iron and Steel Works Committee of the Chinese Communist Party. It seemed that the T'ai-Yuan City Committee of the Chinese Communist Party was the immediate superior organ. The T'ai-Yuan Iron and Steel Works Committee was the highest guiding organ of the Party organization within the iron and steel works. It consisted of a secretary of the iron and steel works committee and several Party members. It was claimed that the committee members were all outstanding personnel within the iron and steel works from the standpoint of ability and experience in the Party. It was claimed that the superintendent, the person in charge of the Administration Office, and the person in charge of the Personnel Office were all Party members. It seemed that several branches and sub-branches exist as lower organs of the committee but details are unknown.

3. Workers' union of the iron and steel works

Its official name was the T'ai-Yuan Iron and Steel Works Workers' Union. At the end of the first quarter of 1953, it was said that the T'ai-Yuan City Iron and Steel Branch (?) (TN Sic.) was the immediate superior organ of the workers' union, and it was affiliated with the All China Federation of Trade Unions through the T'ai-Yuan City General Trade Union. Also, it was said that branch workers' unions were formed in the various shops (worksites) as subordinate organs within the iron and steel works.

Note: It seems that all the organs and their names were changed as a result of the Seventh National Workers' Union Convention of April 1953, but details are unknown.

At that time, the executive department of the iron and steel works labor union was made up of various specialized departments such as organization, general affairs, information and education, cultural recreation and welfare. Of these, the organization department was most active. It seemed that the operation of the workers' union was centered around the organization department and other departments were just subordinate organs.

In regard to the workers' union officials, the higher officials consisted of one chairman, one chief secretary, various department chiefs and several others. The lower officials consisted of branch chiefs of the workers' unions in the various shops. As a rule the officials were elected by all the members of the union, but it seemed that some of the higher officials were appointed from the T'ai-Yuan City General Trade Union. The chairman, chief secretary and department chiefs were regular union employees and the lower officials were workers who took part in union activities beside engaging in their regular production work. The total number of officials was unknown, but it seemed that the number will reach several hundred for the entire iron and steel works because there were about 20 persons in the rolling mill alone. Workers' union officials were mostly Party members and even the number of women officials was not small.

Nearly all of the employees were union members. However, workers who were on disciplinary probation were not admitted into the workers' union. The detained Japanese employees were organized into a Japanese workers' union team.

The activities of the workers' union were directly connected with the iron and steel works (particularly with the Administration Department) and most of its efforts were concentrated on various activities such as production increase movement, training and guiding of workers, culture and recreation, and particularly welfare work. The welfare department of the workers' union had jurisdiction over the labor insurance affairs but its main work was welfare work.

The dues of the workers' union consisted of one per cent of the wage of a union member and it was paid every month on the second wage adjustment day. Some percentage of the total profit was disbursed from the plant as additional operational fund of the workers' union, but in the case of a union of a deficit plant, a certain amount of money was furnished from the General Trade Union of T'AI-YUAN City.

4. Production Control Committee

An explanation of the Production Control Committee will be omitted because its organization, setup, duty and authority are almost similar to that of the production control committee or plant control committee of the state-operated iron and steel enterprises which had been mentioned previously. A production committee is set up in each office, department and shop as a subordinate organization of the production control committee of the plant.

B. Confiscation of the Enterprise

1. Method of confiscation

In general, confiscation of enterprises in Communist CHINA was divided into armed and peaceful confiscations. In armed confiscation, the enterprise was occupied or taken over by means of arms. In peaceful

confiscation, the enterprise was taken over through peaceful means. However, according to the facts of history, even peaceful confiscation was actually a method to take over enterprise through negotiation employing armed threats. The confiscation of this iron and steel works, both in name and in fact, was armed confiscation.

2. Agency in charge of the confiscation

The entire layout of the former Northwest Industrial Company was confiscated by the T'ai-Yuan Light and Heavy Industry Confiscation and Control Team of Communist CHINA. At that time, the Confiscation and Control Team was headed by LAI Chi-fa (presently a vice-minister of heavy industry) and the assistant head was LU Ta (presently assistant bureau chief of the Iron and Steel Control Bureau of the Ministry of Heavy Industry). The former T'ai-Yuan Steel Mill which was attached to this company was confiscated by CHANG P'ei-han (STC 1728/1014/3352), military representative, and KUO Ch'i-ying (STC 6753/1142/2019), assistant military representative.

Note: It is judged that LAI Chi-fa was a higher ranking official than CHANG P'ei-han, but during the confiscation, the attitude of LAI toward CHANG was polite.

Subordinate members under CHANG P'ei-han consisted of liaison members, technicians numbering 10-odd members and a considerable number of office workers. There were some Japanese among the technicians. The total number of the confiscation personnel, including the military representatives, were slightly less than 50. Members of this agency were stationed in the various departments of the plant. Two persons (liaison members) were stationed in the rolling mill. One was a technician (non-Party member and his name was K'O Ch'eng /STC 2688/2052/) and the other was a Party member named KUO.

3. Preparation to confiscation

Members of the confiscation team were appointed a few months before this iron and steel works was confiscated, and they remained in the rear while undergoing ideological and technical training.

These confiscation members gradually moved forward about the time the battle for the liberation of T'ai-Yuan commenced and conducted various concrete confiscation preparations by contacting the underground activity agents within the iron and steel works. In the meantime, detailed studies were conducted on the name, personal history, thought and skill of the Japanese which were to be detained after the confiscation. When the plant was occupied by the Chinese Communist Army, the names of the Japanese were called out through a loudspeaker based on this study and each Japanese was treated courteously. Among the underground activity agents who distinguished themselves in the preparation work, two were selected to influential posts.

4. Confiscation procedures

Confiscation procedures started along with the occupation of the mill. At that time, since nearly all of the old staff personnel such as the plant superintendent, department chiefs, and section chiefs during Chinese Nationalist control remained behind, the confiscation procedure was conducted very smoothly and only about three days were required to complete the first stage of the work.

Thus, the actual authority in the mill management was taken over by the confiscation members. Even the transfer of duties was carried out without any disruption in operation. For instance, at the rolling mill, a Japanese technician was courteously asked by the confiscation member in charge (K'O Ch'eng, a liaison member mentioned previously) to supervise the mill operation. The said Japanese technician refused on the grounds that his knowledge of Chinese was inadequate. However, a joint management of this mill was suggested by K'O Ch'eng who then became the head of the mill while the Japanese technician was placed in charge of technical affairs.

5. Prevention of work stoppage

Operable workshops continued their operations from the day after the mill was occupied. However, in general, full operation could not be conducted. In this manner efforts were exerted to continue the flow of raw materials and also to prevent the cooling of furnaces.

6. Appeasement of workers

Many of the workers deserted the mill immediately before its occupation or did not report to work after the confiscation by the Chinese Communist. The confiscation members immediately took action to appease the workers and exerted utmost efforts to have these workers return to the workshops. Furthermore, action was taken to reinstate workers who had retired two to three years ago or those who had been discharged during Chinese Nationalist control for unjustifiable reasons. In this manner, the personnel necessary in operating this iron and steel works were quickly remobilized.

7. Indoctrination

Indoctrination of the workers was conducted immediately after the confiscation. First of all, political training was conducted. A worker was made to understand the slogan that he was the boss of the mill. At the same time, progress in indoctrination of the workers was planned through practical action such as the liquidation struggle. However, the liquidation struggle in this iron and steel works was conducted rather mildly. In general, persons who became the targets of liquidation were handled leniently and none of them received any punishment worth mentioning. It is judged that this was due to the fact that influential members and old staff members of this iron and steel works were all followers of YEN Shih-shan.

8. Rehabilitation work for commencement of operations

Facilities which could be operated went on partial operation immediately after the confiscation of the mill. However, three to four months were necessary in procuring raw materials and in preparing the various departments of production for regular operation. The rehabilitation of idle facilities commenced from this period and in September 1949 the operational setup for the entire works was nearly completed.

C. Establishment of Operational Structure

1. Production Control Department

a. In autumn 1949, the iron and steel works affairs section was newly created under the direct guidance of the assistant plant superintendent in charge of production to normalize the control of the works' affairs. A production team was set up in this section as the organ responsible for production control. However, when the section first began

to function, the section actually did not know where to begin because its duties were vague and there were only two or three persons attached to the production team. However, various types of original records (work diary, daily operational report and various vouchers) were being kept by each workshop within the iron and steel works from the days of Japanese control. Therefore, the production team used these records as a basis in drawing up various statistical tables and engaged in the publication of monthly statistical reports.

b. In early 1950, the iron and steel works affairs section was dissolved when the production team was reorganized and formed into the production control section. The statistics, planning, technical, and safety teams were created in the production control section. Thus, the statistical work and planning work were separated and the safety control work and technical guidance in production became specialized. As a result, the work assignment in production control was clarified for the first time and the purport of each work became clear. Workshop production also began to run smoothly from about this time.

c. In late 1951, the statisitcal form was revised and the statiscal form of the USSR was adopted. Along with this adoption, the statistical team and planning team were separated from the production control section and a new planning section was created. At the same time, the safety team became independent and was promoted to a section. The production control section was expanded centered on the technical team and was reorganized into an organ which embraces the production team and technical team. However, even after these changes, the planning, safety and production control sections still remained under the jurisdiction of the assistant plant superintendent in charge of production.

d. In November 1952, a vast reorganization of the control organ of this plant was carried out along with the national reform of the administrative organ. The planning section became the Planning Office along with the establishment of the State Planning Committee, and this office was placed under the direct supervision of the plant superintendent. At the same time, the planning team was promoted to the planning section and the statistics team was promoted to the statistics section. The production control section was dissolved to form the Production Office. At the same time the production technique section, technical safety section, technical supervision section and the controlling organs of various workshops and plants were newly created or embraced within this office (see Chart No 10-67).

The structure, duties and personnel of the production technique section and technical supervision section are shown on Tables No 10-87 and No 10-88.

2. Basic Construction Department

a. A civil engineering and construction subsection was included in the engineering section during Japanese control before the end of the war. Its personnel consisted of 100 carpenters, 100 masons (does not include personnel who were connected with setting up furnaces), 50 day laborers, 200 construction workers and 50 trackmen. However, the line construction work was thereafter placed under the jurisdiction of the transportation section.

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b. During Chinese Nationalist control after the end of the war, the civil engineering and construction subsection was renamed the civil engineering and construction division but there was no great change in personnel or the setup.

c. After the Chinese Communists took control, the engineering section continued to exist as it was until autumn 1949. The planning division which took charge of engineering work connected with machinery and the civil engineering division which took charge of civil engineering were both attached to this section. However, in general, the workers were being dispersed or changing their occupation and the number of personnel was decreasing.

d. In autumn 1949, the engineering section was dissolved along with the establishment of the Planning Department under the direct jurisdiction of the superintendent of the iron and steel works, and the planning and civil engineering divisions were absorbed into the Planning Department. LI Shu-jen, a Chinese technician, was appointed to take charge of the Planning Department, but the main body of the technical force of this department was made up of detained Japanese centering around TAKAHASHI Tetsuzo (高橋鉄蔵), the former mill superintendent. However, there were about 20 Chinese technicians attached to the technical force.

e. In February 1950, the Construction and Engineering Office was set up according to orders from the Central Government and the Planning Department was absorbed into this office. KUO Ch'i-ying, assistant military representative at the time of the confiscation, was appointed Chief of the Construction and Engineering Office. Thereafter, along with the materialization of the basic construction plan of the iron and steel works, the detained Japanese technicians who had been engaged in production guidance at the workshops of various plants up to that time were gradually assembled and assigned to the Construction and Engineering Office and they took over the planning work. In late 1951, nearly all of the Japanese technicians were separated from the production departments of the workshops and they were working in the Basic Construction Department.

f. In autumn 1952, the Basic Construction Office was newly established and along with this establishment, the Construction and Engineering Office was assimilated into the new office. Among the personnel attached to the Basic Construction Office at the time that the office commenced functioning, those that have been verified as a result of this survey are as follows:

(1) Number of technicians attached to the Basic Construciton Office (autumn 1952)

(a)	Chinese technicians	25
1	College graduates	4
2	Higher technical school graduates	3
3	Middle school graduates	1
4	Higher girl's school graduates	2
5	Former apprentices	5
6	Others	10

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(b) Japanese technicians about 15

(c) Total about 40

Note: 1. Former apprentices were Chinese technicians who were trained and fostered by Japanese technicians after the Japanese era.

2. All of the Japanese technicians numbering about 15 persons were repatriated in spring 1953.

(2) Number of workers of the Construction and Engineering Department of the Basic Construction Office (autumn 1952)

(a) Personnel connected with plant construction 1,000

(b) Personnel connected with housing construction 1,000

(c) Total number of personnel 2,000

Note: In the work conducted by the Basic Construction Office, the Construction and Engineering Department was the organ which took charge of the actual execution and it is assumed that the majority of the workers attached to basic construction work belonged to this department. Along with the establishment of the Basic Construction Office, all the workers and laborers belonging to the subcontractors dealing with the iron and steel works at that time were hired as workers of the iron and steel works and attached to the Construction and Engineering Department.

3. Plant Security Department

a. During Chinese Nationalist control after the end of the war, security of the works was the responsibility of the guard unit. The guards at that time were armed with old Chinese-made rifles that the Japanese ex-servicemen living in the area used for training before the end of the war.

b. After the Chinese Communists took control and up to 1951, the guards were organized and armed as they had been in the past. The guards took part in training such as armed drills and double time and quick time exercises every day in the open space within the works compound. Officers among the guards took charge of training.

c. Thereafter, the guards wore the mark of the "People's Liberation Army" and it seems that the name was changed to plant security unit, but the date of its reorganization is unknown. At any rate, the unit was under the jurisidiction of the Plant Security Office at the end of the first quarter of 1953. The first, second and third security sections were the operational organs and it seemed that the plant security unit under its jurisdiction was directly engaged in guarding the works.

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d. The plant security unit was on duty 24 hours a day and about 100 plant security guards were usually on duty at each shift. Also, during the night, ordinary workers armed with rifles took part in sentry duty by shifts under the guidance of the plant security unit.

e. Security stations were located at each gate, power plant, by-products plants, water pumping station, etc and four to five security guards were always on duty at these stations. Electrified barbed wires were strung around the outer wall of the iron and steel works. Also, barbed wires were strung around the power plant located inside the compound. It was claimed that these measures were taken to prevent destruction by antirevolutionary elements.

The by-products plant and power plant were guarded very closely. Even workers of this iron and steel works had to have a gate pass (wooden ticket) issued by the power plant or Chemical Department to go into the workshops of these plants. Furthermore, permission from the security guards was necessary.

Also, admittance to the basic construction sites was closely guarded. At the time the coke oven and coal washing plant were constructed, workers other than those designated by the Basic Construction Office were not permitted to enter the construction sites. These designated workers possessed a piece of red cloth to show that they were the designated workers. Guards were posted at workshops during trial operation following the completion of construction, and unauthorized persons were not permitted into the premises.

D. Planning Procedures

This iron and steel works adopted the overall planned economy system following the administrative reform in autumn 1952. Even prior to this, rudimentary steps in planned control were gradually being carried out in the various departments of production, sales, finance and basic construction. However, this control was inadequate. In autumn 1952, the State Planning Committee was created in the Central Government along with the reform of the administrative setup throughout the nation, and a planning organ was set up in each state-operated plant. In conformity with the setting up of the planning organ, the various departments of production, sales, finance and basic construction were expanded, and along with the commencement of the First Five-Year Plan in 1953, each state-operated enterprise entered the stage whereby operation was carried out under the overall planned economy system. Even at this iron and steel works, the process of setting up, expanding and strengthening the planning, production and basic construction offices were conducted in autumn 1952, and from 1953 the actual planned control system based on the Soviet method was enforced. The following is a summary of the actual condition concerning the planning operation of this iron and steel works up to the end of the first quarter of 1953 that have been verified.

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1. Types of annual plans and organs in charge of planning

Types of annual plans, organs in charge of drafting the plans and the cooperating organs during the 1953 fiscal year were as follows:

Type of plan	Main organ in charge	Cooperating organ
Production plan	Planning Office	Production technique section of the Production Office
Raw material plan	" "	" " "
Labor plan	Personnel Office	Expenditure section of the Accounting Office
Sales plan	Business Office	" " "
Finance plan	Accounting Office	
Basic construction plan	Basic Construction Office	

Note: 1. It is believed that the Planning Office has overall control of the planning operation.

2. The expenditure section is the organ in charge of cost accounting and cost control.

2. Details of the production plan

a. Types of production plans

Production plans consist of the following three types:

(1) Production Plan No 1 -- production volume plan

(2) Production Plan No 2 -- technical requirements plan

(3) Production Plan No 3 -- products quality plan

b. Production plan charts

Various production plans such as plan No 1, plan No 2, and plan No 3 are drafted by entering the essential information in each of the fixed type of production plan chart. Thus, details of each of the production plans are plainly indicated on the production plan charts.

The following list shows examples of the various production plan charts of the blast furnaces and open-hearth furnaces adopted since 1953.

(1) Production plan chart for blast furnace No 1 -- see Table No 10-89.

(2) Production plan chart for blast furnace No 2 -- see Table No 10-90.

(3) Production plan chart for blast furnace No 3 -- see Table No 10-91.

(4) Production plan chart for open-hearth furnace No 1 -- see Table No 10-92.

(5) Production plan chart for open-hearth furnace No 2 -- see Table No 10-93.

(6) Production plan chart for open-hearth furnace No 3 -- see Table No 10-94.

Note: The production plan chart for the electric furnace corresponds to the production plan chart for the open-hearth furnace.

3. Procedures in the preparation of annual plans

a. Drafting and presentation of the nation plan

(1) At the beginning of the second half of each year, the State Planning Committee request through the Ministry of Heavy Industry that this iron and steel works submit the production data of the year concerned (previous year of the planned fiscal year). This data is used as the basis for drafting the outline of the national plan for the coming year.

Note: The request that these basic data be submitted is made to all the state-operated enterprises.

(2) Usually by late September, the State Planning Committee will have prepared an outline of the national plan for the coming year based on the above-mentioned production data submitted by the various state-operated enterprises (including this iron and steel works) and on the basic policy regarding the drafting of state plans for the coming year as stipulated by the Central Government (State Council).

Note: 1. The outline of the state plan is compiled based on the composite control statistics embracing all industries and all state-operated enterprises, and the separate control statistics of each industry and each state-operated enterprise which had been apportioned according to the actual condition of each industry and each state-operated enterprise.

2. The control figures form the framework in the drafting of the plan and are the basis for preparing the planned figures. They also constitute the general target figures which each industry and each state operated enterprise will be requested to accomplish during the coming year. Therefore, each plant must draft various plans for the coming year with the object of attaining these figures.

(3) When the outline of the national plans is completed (generally from late September to early October), the State Planning Committee will call to session the "All China State-operated Iron and Steel Works Superintendents and Mine Bureau Chiefs Conference" under joint sponsorship

with the Ministry of Heavy Industry. The outline of the national plans will be presented at this conference, and basic policies and standards (control figures) will be announced so that each plant and mine can draw up their annual plans. Also, during this conference, the standards for drawing up the production plans and plans for equipment required (basic construction plan) for production will be clarified.

b. Preparing the annual plans of a plant

(1) Following the adjournment of the "All China State-operated Iron and Steel Works Superintendents and Mining Bureau Chiefs Conference", the superintendent of this iron and steel works will return with the control figures for the coming fiscal year and immediately summon a staff conference, and make an evaluation for drafting the annual plans for the coming year. This conference is generally held in mid-October and it lasts for several days. The outline for drafting annual plans is decided upon as a result of this conference.

(2) This outline is then passed around to the Planning Office and other organs in charge of various plannings, and each organ will draw up a detailed draft based on this outline. For example, the Planning Office, as the main organ in charge, will draw up the draft on the production plan but actually large-scale assistance is necessary from the production technique section. The reason for this is that the Planning Office is mostly made up of special office workers and contact with the workshops is maintained only by means of statistics and data. Therefore, in drafting a plan, the office does not have concrete knowledge of the actual conditions and special techniques of the workshops. In contrast to this situation, the production technique section has numerous technicians directly connected to the workshops in addition to office workers. Therefore, the assistance of the production technique section is indispensable in drawing up plans which will conform to the actual conditions at the workshops.

(3) When the drafts on the detailed plans of each department are drawn up, the drafts will be immediately mimeographed and distributed to each department and section. Then each department and section will submit the drafts for open deliberation at their attached workshops. This period generally lasts about one month from late October to late November. During this period, the workers of each workshop will attend work early and remain behind after work everyday to deliberate on the draft. This deliberation is conducted during off-duty hours and is continued

until a satisfactory decision is reached. The basic policy of this deliberation rigidly stresses the accomplishment of the goal for greater reproduction and it doesn't always adhere to the figures given in the draft. The principal objective of this deliberation is placed on various policies for increasing production, and for research and discovery of new methods to remove the bottlenecks in the workshops. At this time, an analytical study will be made of the new records on production within and without the iron and steel works, and various calculations will be made based on improving the norms attained in all concrete operational methods. Therefore, the studies and modified opinions submitted on the draft will be well down to earth.

However, in this event, there is a fear that exaggerated planned figures and subjective commitments may be made owing to the false front put up by the workers and the lack of technical knowledge. Therefore, in order to anticipate technical accuracy and careful analysis, specialists are dispatched from the Planning Office and the production technique section to take part in the deliberation and give technical guidance.

Furthermore, to create an atmosphere for supporting the draft in the workshops, the Planning Office and the production technique section at times will conduct various preparatory activities before the draft is introduced. Also, the Youth Corps, workers' union and Party branches in the iron and steel works will engage in active education, propaganda and instigation activities among the workers in regard to the drafting of the plans.

(4) The result of the open deliberation at each workshop will be reported to the plant superintendent through the jurisdictional departments and sections. This report concretely indicates the opinion and reasons for modifying the draft. The main organ in charge will draw up the final plans for the iron and steel works by conducting further studies on these opinons and by making necessary modifications on the draft.

In the event that the demand (control figures) of the state cannot be accepted -- for example when the control figure in view of the present productive conditions is unreasonable -- a facility improvement plan will then be attached to the final plan and presented to the Central Government. In other words, it is submitting a conditional plan. At times, plans exceeding the control figures are submitted.

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Note: At the time the 1953 fiscal year plan of this iron and steel works was drafted, the effective utilization index of blast furnace No 2 as indicated by the Central Government was 0.9 cubic meters per ton per day. However, the index was revised to 1.0 cubic meters per ton per day in conformity to the actual situation. Also, the control figure for open-hearth furnace steel manufacturing was 134,000 tons, but it was revised to 130,000 tons as a result of the deliberation within the iron and steel works. Furthermore, as a condition for attaining the steel output of 130,000 tons, the installation of 70-ton ladle cranes was requested to the Central Government. This request was granted.

c. Studies conducted prior to the drafting of plans

Prior to drafting the 1953 plan, the iron and steel works conducted serious studies concerning the planning. All persons concerned including the superintendent of the iron and steel works participated in this study which was held around October and continued for about one month. The guide to planning work (title of book is unknown) published by the Financial and Economic Affairs Committee was used as the textbook for this study. The content of this textbook deals with the stipulations and explanations of the unified planning work which is adopted universally throughout the country.

It is said that these stipulations were established by Soviet planners (Soviet nationals employed as planning specialists), and various computation methods necessary to the planning work are described in detail and concrete form. Also, the textbook contained numerous direct transliteration of Soviet stipulations.

These stipulations were consolidated by the Central Government authorities in late 1951. However, the method of computation based on these stipulations was not rigidly applied when drafting the 1952 fiscal year plan. Studies prior to planning by all persons concerned, including the superintendent of the iron and steel works, became absolutely necessary because all the work for drawing up the 1953 fiscal year plan was based on these stipulations.

d. Approval of the fiscal year plans

(1) In late November, the "All China State-operated Iron and Steel Works Superintendents and Mining Bureau Chiefs Conference" is once again convened under the joint sponsorship of the State Planning Committee and Ministry of Heavy Industry. The superintendent of this iron and steel works, accompanied by his subordinates, attends this conference to submit the fiscal year plan of the iron and steel works and explains the important points in the plan. Other superintendents and bureau chiefs participating in this conference also carry out the same procedure.

(2) The State Planning Committee makes a concrete study of the plan submitted by each plant or mine and sanctions the plan if there is no objection. However, if the committee is dissatisfied with the plan, the plant or mine is requested to re-study the plan. Also, if the committee recognizes that the contents of the plan are unreasonable, the plant is ordered to submit a revised plan with improvements made on various conditions such as facilities, raw materials and labor.

In the event of a re-study, the superintendent, as soon as he returns to his plant, drafts a revised plan through open deliberation. In this event, some sacrifices must be made to draft a revised plan coinciding with the requests made by the Central Government.

(3) After judgment is passed by the State Planning Committee on the fiscal year plan of each plant, the plan is submitted to the State Council as an approved plan. The State Planning Committee drafts a comprehensive state plan based on the approved plans of all industries and all state-operated enterprises, and submits it to the State Council. Thus, all plans passing the State Council are designated as state plans. These state plans are then forwarded as directives to the affiliated state-operated enterprises via the ministry. The directive is the same as a law and the responsible plant must absolutely guarantee its accomplishment or surpass its designated goal.

Note: The State Planning Committee was created in November 1952. Therefore, the work and affairs handled by this committee before its establishment was done by the Financial and Economic Affairs Committee of the Central Government. Also, the Planning Office of this iron and steel works was created in autumn (November ? /TN Sic./) 1952. Therefore, the work and affairs handled by this office before its establishment was done by the planning section of this iron and steel works.

4. Basic construction plans

a. Procedure in deciding on the basic construction plans

In regard to basic construction plans, the Central Government either decided on the plans one-sidedly and made official and unofficial announcements, or the Central Government approved the requisitions of the various plants and decided on the plans according to the recommendations contained in the requisitions. Official and unofficial announcements are generally made in August of the year before the fiscal year plan is put into execution.

b. Significance and scope of the basic construction plans

The basic construction plan is a mass reproduction plan on the fixed assets and the execution plan of basic construction work prescribed by the basic construction temporary laws. Repair and construction plans covered by the working expense of the financial affairs regulations are not included in this plan.

c. Basic construction and production plans expected to be accomplished within the fiscal year

According to the basic construction plans and conditions of their progress, the new facilities expected to be completed within the fiscal year will be included in the production plan as actual productive capacity generally during the following instances:

(1) Facilities will be officially included in the production plan from the period after the expected time of completion (generally at the end of each period) when the facilities expected to be completed do not necessitate particular technical skill during the trial operation after completion, or when the workers operating these facilities are considered to be sufficiently experienced so that full operation can be carried out without undue waste of time.

(2) The facilities expected to be completed within the year cannot be included in the fiscal year production plan in cases other than those mentioned above or when the expected date of completion falls in the latter half of the year. In the latter case, the production result of the new facilities after completion should be included in the output outside the plan. At times, however, it seemed that this output is included as the surplus attained on the fiscal year production plan.

In short, it seemed that the question of the period is decided according to the stability of the technical operation and by the demands of the state plan, and it is extremely doubtful whether there is a fixed rule concerning this matter.

In the iron and steel works, concrete examples which apply to this matter occurred frequently in the 1952 fiscal year when numerous basic construction projects were carried out. In drafting the production plan for the 1953 fiscal year, the handling of the sheet rolling facilities which were expected to be included in the plan at the beginning of the year became a great problem. In the first place, there was no trial operation on sheet rolling at the iron and steel works. Therefore, the degree of technical skill and the amount of time required for the trial operation could not be definitely calculated. Consequently, there was even a proposal at the beginning that this matter be handled as an unplanned (not included in the plan) production, but since the sheet rolling facilities were definitely going into operation from the beginning of the year, a temporary plan was drafted and included into the fiscal year plan.

Also, the two 8-ton electric furnaces which were expected to be installed in autumn 1953 had not been included in the fiscal year plan because technical stability was lacking in the production plan for the two 3-ton electric furnace which began operating in autumn of the previous year.

5. Drafting of quarterly plans

a. The quarterly plan is a short term concrete plan drafted for each of the four quarters in executing the fiscal year plan.

b. The quarterly plan is drafted under the supervision of the superintendent of the iron and steel works. However, the plan is submitted to the Ministry of Heavy Industry after it is drafted and upon approval, it becomes effective as an order of the Ministry of Heavy Industry. The principal organ handling these plans within the iron and steel works is the same as in the case with the fiscal year plan.

c. The type of quarterly plans corresponds to that of the fiscal year plan.

d. In drafting up the quarterly plan, it is essential that the progress in the operational efficiency of the previous quarter within the scope of the same fiscal year plan be taken into consideration and moreover that the opinions of the workshops be requested and liaison and conferences be held with organs connected with basic construction, sources of raw materials, destinations of finished products and semiprocessed products, and transportation organs. The conditions derived from the foregoing means are then thoroughly digested before drafting the quarterly plan which is far more concrete than the fiscal year plan.

e. The first quarterly plan is drafted in December of the previous year, the second quarterly plan is drafted in March, the third quarterly plan in June and the fourth quarterly plan in September. Each quarterly plan must be approved by the Central Government.

6. Drafting of monthly work plan

a. The monthly work plan is also a program of concrete, practical methods for executing the quarterly plan by separate months. Also, it is the milestone which indicates the progress made in the fiscal year plan.

b. The assistant superintendent in charge of production supervises the drafting of the monthly plan and submits this plan to the Ministry of Heavy Industry as a regular report of the iron and steel works. However, this is not done as an order by the Central Government. In other words, the drafting and execution of this plan is conducted within the jurisdiction and responsibility of the superintendent of the iron and steel works.

c. The production and technical section is the organ in charge of planning.. When the production and technical section drafts a plan, the plan is sent to each department concerned before an approval is obtained from the assistant superintendent in charge of production. After this procedure is completed, the plan is announced as a production order for the iron and steel works.

d. The monthly plan is drafted according to the quarterly plan, but it was much more concrete, than the quarterly plan. Furthermore, this plan must closely coincide with the daily production progress.

Even in the quarterly plan, matters relating to the products such as items, amount, sizes, quality, distribution points and dates of shipment are concretely stipulated as a result of recent liaison. Also, in regard to raw material supply, the items, amount, sizes, quality, composition, supply sources arrival date of supplies, and consumption of each required raw material are stipulated in detail. However, to begin with, the quarterly plan is drafted within the scope of the same fiscal year plan and the fiscal year plan is generally drafted during the second half of the previous year. Consequently, the various changes in production conditions and progress in operational efficiency are not thoroughly covered in the plan.

In contrast to this situation, the monthly plan takes into consideration the statistical mean progressive value of the various production indexes of recent months and actual conditions of repairs on facilities, calculates the various production indexes which is actually possible, and is based on the daily work result. The plan is drafted to coincide with the various plans such as that for product and raw materials which are stipulated in the quarterly plan.

e. The monthly plan is clearly prescribed by reporting the important matters on a set form of statistical table. Table No 10-95 is an example of the monthly statistical table for the steel manufacturing department of the iron and steel works for the 1953 fiscal year.

7. Drafting of weekly working plan

a. The weekly working plan is drafted according to the main points of the draft on the monthly working plan. However, in comparison to the monthly plan, the contents of the weekly plan are much more concrete, practical and detailed. For instance, plans for transportation at the raw material yard, operation of cranes, operation of various equipment, and purchasing of raw material by the special raw material section are prepared in detail.

b. The production and technical section is the organ in charge of drafting the weekly plan. According to the instruction from the assistant superintendent in charge of production, the production and technical section requests the workshops of the various departments concerned to submit a draft of the weekly working plan. These working plans are then compiled and organized for the preparation of the weekly working plan for the iron and steel works. With the approval of the assistant superintendent in charge of production, this working plan is sent to each department as an order of the iron and steel works.

c. Taking the weekly working plan of the steel manufacturing department as an example, the existence of only one ladle crane in this department up to the end of the first quarter of 1953 constituted the greatest bottleneck at the steel manufacturing workshop of the open-hearth furnace. Therefore, a detailed steel output timetable with fixed time differences to avoid identical steel output time among the three open-hearth furnaces was established and included in the weekly working plan of the department. This timetable was similar to that used for train schedules.

8. Drafting of daily working plan

The daily working plan is drafted by each production unit at the workshop and submitted to the assistant superintendent in charge of production. However, this plan is not submitted to the Central Government. The form is also similar to the original data record of the voucher type.

9. Original data record

The original data record of the iron and steel works does not adhere to the statistical stipulations, and its form is not always the same as that of other plants. It is not bound by special control orders from the Central Government and there is no distribution of a set original data record form.

As an actual problem, there was no nationalized standard form for the original data record up to the end of the first quarter of 1953. The equipment, working process and even the raw material conditions differ according to each plant, and if these things were forcibly standardized, it may then result in an abstract form and actual records cannot be obtained.

Therefore, each plant studied the data of other plants and endeavored to draw-up an original data record form which was most suitable to its own plant. In the case of this iron and steel works, the data did not differ greatly with that of the Japanese controlled era and the point which was different was the three-shift system.

10. Preparation and presentation of monthly statistical reports

Statistical reports are drawn up every month based on statistical stipulations and submitted to the Ministry of Heavy Industry within a certain time. The statistical section of the Planning Office and the cost accounting section of the Accounting Office are in charge of statistics. These sections prepare a report based on the statistics and cost accounting data submitted from the workshop office of each production department and this report is submitted to the superior authority.

11. Catalogue of products

Once every year, a "Catalogue of Products" is published by the Iron and Steel Industry Control Bureau of the Ministry of Heavy Industry. It is primarily used as reference material for drafting financial plans. The catalogue of products clearly indicates the standard, size, quality, manufacturer and cost of items covering various finished products, semifinished products, raw material, and consumption goods. The catalogue consists of several volumes, and each volume is about the size of a Japanese telephone directory. Its contents were something like an official price list on commodities. However, in numerous instances the prices shown in the catalogue of products differed with the actual purchasing price and it was claimed that this inconsistency sometimes hindered the preparation of plans and the concluding of sale contracts.

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E. Economic Accounting System and Production Cost Controls

1. Economic accounting system

a. Significance of economic accounting system

The economic accounting system corresponds to the Khozraschet of the USSR. This system is claimed to be the basic method in which socialistic enterprises perfect their planned management under the self-supporting accounting system. The operation of each enterprise is planned under the system as previously mentioned, and production, sale, work, material finance and basic construction must be executed according to the plan. Since these operations are mutually placed on a coordinated system, plans are made so that a certain balance is maintained. Therefore, a management and control method based on an exact accounting system becomes essential even in executing these operational plans. The planned management system based on this accounting system is the economic accounting system. Therefore, the economic accounting system can be also called the management accounting system of enterprises under the planned economy system.

The economic accounting system not only guarantees that the enterprise executes its operation according to plans, but also guarantees that the enterprise executes its operation to attain maximum results with minimum expenses. In other words, the system not only guarantees the manufacture of a fixed amount of products by means of fixed facilities, funds, labor, raw materials and fuel, power and technique within a specified time, but also has the basic requirements which are to economize the expenses to the minimum, increase the amount of planned production to the maximum and shorten the period of planned production to the minimum. Consequently, the mission of the planned production based on the economic accounting system is to produce more than the planned amount without exceeding the planned expenditure. It can be said that the various production increases and economizing movements, new record establishing movements and patriotic production competitions were inseparably related to the adaptation of the economic accounting system.

Owing to these facts, a rational and economic control of various expenditures and the increase in productivity of equipment and labor power become the major problems for enforcing the economic accounting system. These two problems in turn are condensed into one problem which is to decrease the cost. Therefore, the production-cost control system holds the most important position among the various control systems (fixed control systems) under the economic accounting system.

b. Enforcement date of the economic accounting system

There is no verified information on the enforcement date of the economic accounting system for this iron and steel works. It is judged that the complete enforcement of this system began after the 1953 fiscal year. However, even prior to this time, various measures inseparably related to this system were gradually being enforced as much as possible. For instance, the rebate of the iron and steel works superintendent fund in 1952 from the profits of the previous year of the iron and steel works can be given as an example.

Note: 1. The reason for judging that the complete enforcement of the economic accounting system began after the 1953 fiscal year is• that the planned management system for this iron and steel works was completed after autumn 1952.

2. The iron and steel works superintendent fund is a fixed amount that the superintendent sets aside from the planned profits and excess profits of the planned amount as the iron and steel works fund, and this amount is retained within the iron and steel works. Since this system is inseparably related with the enforcement of planned production and economic accounting system, it is one type of reward money granted when the plan is accomplished or exceeded. The superintendent fund of this iron and steel works in 1952 was said to be 29 per cent (30-odd hundred million yuan) of the total profit of the previous fiscal year. After deducting the superintendent fund, the remainder of the profit is turned in to the national treasury. The superintendent fund is used for expanding the operations of the works, for welfare facilities of the workers for reward money to outstanding workers.

c. Units enforcing the economic accounting system

The economic accounting system is enforced collectively with the entire iron and steel works as an unit. However, if each department within the iron and steel works is adopting the self-supporting accounting system, the economic accounting system is then enforced with each department as an unit. In 1953, the following 13 departments of the iron and steel works were enforcing the economic accounting system as separate units:

(1) Coking department

(2) Pig-iron manufacutring department

(3) Steel manufacturing department

(4) Medium rolling department

(5) Small bar rolling department

(6) Sheet Rolling department

(7) Chilled casting

(8) Electric steel manufacturing department

(9) Refractory material department

(10) Motive power department (including water supply)

(11) Workshop department

(12) Transportation department

(13) Management department

2. Cost control

The main organ in charge of controling cost is the cost accounting section of the Accounting Office. Functions of the cost accounting section are the calculation of cost, drafting of the cost plan, and control and supervision in the course of carrying out the plan. In the strict sense of the word, the control of cost refers to the realization of the planned cost through control and supervision. However, a general description will be given also on other duties of the cost accounting section which are related with the control of cost and which were made clear as the result of this survey.

a. Breakdown of the cost

A breakdown of the cost is as follows:

(1) Iron and steel works cost (Production and sales cost)

(2) Plant cost

(3) Workshop cost

(4) Basic material cost

(5) Auxiliary material cost

(6) Base pay

(7) Fuel cost

(8) Power cost

(9) Steam cost

(10) Water supply cost

(11) Consignment processing cost

(12) Workshop cost

(Items [4] to [12] are direct costs)

(13) Plant management cost

(14) Iron and steel works management cost

(15) Sales cost

(Items [13], [14] and [15] are indirect costs)

Note: The relationship of these costs are as follows:

(1) = (2) + (14) + (15)

(2) = (3) + (13)

(3) = (4) + (5) + (6) + (7) + (8) + (9) + (10) + (11) + (12)

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Additional explanations on cost factors are:

(1) Base pay

Base pay is the pay and allowance given to workers directly engaged in production. This pay and allowance includes the regular pay, excess production bonus, overtime work pay, regular attendance bonus and hazardous work allowance.

(2) Expenditures for such items as fuel, power, steam and water supply are all for industrial purposes. In other words, it is the cost for items consumed directly for production purposes.

(3) Workshop expenditure, with the exception of expenses directly included in the cost price of various products, includes all other expenses that arise in the workshop. Breakdown of the expenses is as in the following.

(a) Indirect wage cost

This expenditure consists of wages paid to workshop workers (technicians, statisticians and recorders) who are not directly connected with production.

(b) Non-productive workers' wage cost

This expenditure consists of wages paid to shop workers who receive wages according to provisions although they are not engaged in production. For example this wage is paid to workers who are temporarily idle because of injury received while on official duty, workers attending conferences, workers on sick leave, workers idle because of suspension of machinery operation, workers getting married, workers attending funerals, and women workers giving birth or taking care of their children.

(c) Expendable items cost

This expenditure consists of the consumption cost of expendable supplies, fuel and other articles which are not used directly for production purposes in the shop, and of tools, patterns, instruments and appliances which do not come under the category of fixedassets.

(d) Cost of water supply and electricity which are not used directly for production purposes in the shop.

(e) Transportation cost

Transportation cost includes wages for workers engaged in transportation work in the shop, all expenses incurred from transportation in the shop, and expenses assessed to this shop by the department of transportation.

(f) Repair cost

This expenditure consists of expenses for ordinary repairs carried out for maintaining the progress in production process. This expenditure includes wages for workers engaged in repair works in the shop, all costs arising in connection with repair work, and expenses assessed by the repair shop.

(g) Testing and inspection cost

This expenditure includes all expenses incurred in carrying out inspections and tests within the shop.

(h) Office expenses

Office expenses consist of the cost of stationery used in clerical work within the shop.

(i) Heating cost

(j) Expenditure for safety measures

This expenditure includes all expenses incurred in guaranteeing the safety of workers in the shop.

(k) Insurance cost

Insurance cost consists of expenses incurred in insuring fixed assets against floods, fires and other calamities.

(l) Rental fee for the use of assets in the shop

(m) Taxes to be borne by the shop

(n) Depreciation

(o) Shop expenses other than those listed above

(4) Plant and iron and steel works management cost

This cost includes all expenses incurred in the operation and management of plants and the iron and steel works. The breakdown of this cost is as follows:

(a) Administrative management cost

This cost includes indirect wages, water supply and electricity charges, transportation cost, repair cost, cost of various expendable items, office expenses, correspondence expenses, communication expenses, traveling expenses, heating cost, insurance cost, rental fee, taxes, depreciation and others.

(b) General management cost

Wages and expenses for the testing and inspection of products, material safekeeping cost, designing and drafting cost, research and experiment cost, public security cost, loss from calamities in general, education and welfare cost and others.

Note: Since it is believed that additional explanation on the cost factors other than those given above is unnecessary, no further explanation will be given.

b. Cost accounting

(1) Details on cost accounting

(a) This iron and steel works was not financially independent for some time after coming under Chinese Communist control. This works was operated under the supply system (government issue system -- whereby all costs are paid by the Central government) or under a system which conformed to this system, and thus the problem of commercial profit was not given much thought. Consequently, exact calculation and control of production cost was not carried out and moreover regulations for carrying out cost accounting were not adequate.

(b) Calculation of cost at this works was strongly emphasized after the new record establishment movement in 1950. During this movement each workshop became absorbed in the problem of increasing production and in establishing new production records, and they overlooked the

wear and tear on machinery and the waste of raw materials. As a result, the production cost was comparatively high, and in spite of the increase in production, the works operated under a deficit. The turnover of liquid fund dropped because of the inordinate purchasing of raw materials.

With the carrying out of the above movement, the self-supporting accounting system became an issue, and the enterprise authorities made efforts to rationally lower the production cost. The problem was to establish a planned cost based on an exact calculation of cost, and to intensify the control on various items, especially raw materials. The actual condition at that time, however, made it impossible to swiftly solve this problem because the economic accounting system was not established, the planned production system was imperfect, adjustment and re-evaluation of fixed assets and examination of the liquid fund were not fully carried out, and the cost accounting system itself was not fully installed.

(c) It was after the end of 1951 that this works actually began carrying out cost accounting. It is believed that this is largely attributable to the struggle against wastes enforced during the Three-anti Movements.

As previously related, the iron and steel works superintendents fund was withheld by the works in 1952. From this fact, it is presumable that elementary planned production and planned cost, as well as cost accounting which forms the foundation of planned production and planned cost, were already carried out at that time.

(d) It was in 1952 that the system and method of cost accounting in state-operated enterprises was standardized. In the same year the Finance and Economic Committee of the Central Government made public the "Cost Accounting Regulations". Since then, cost accounting based on these regulations has been fully carried out at this works.

These regulations were drawn up with the system currently adopted in the USSR as the standard. It is reported that Soviet cost accounting experts have been invited to PEKING for the purpose of giving instructions in the preparation for and execution of cost accounting. Details on the contents of the regulations are unknown.

(2) Collection of data for cost accounting

As previously related, the main organ in charge of calculating the cost is the cost accounting section. The cost accounting section requests the various operational departments to submit data for calculating the cost regularly or as deemed necessary. In each department, there is a person in charge of cost who gathers and submits the original data of his respective department or workshop. For example, even the technical supervision section, which is not directly connected with production, minutely calculates the amount of electric power, labor and maintenance cost required for each physical test, chemical analysis and metallographical test and reports these data to the Accounting Office. The Accounting Office forwards these data to the cost accounting section where they are classified and arranged. The production cost is then derived through precise calculation based on the above data.

Note: In early 1953, the sale price of steel ingot (mild steel) was 600,000 yuan per ton. This price was not established by this works but it was rather the official quotation decided uniformly by the authorities of the Central Government. The price of the Lung-yen ore (55 per cent iron content) mainly used by this works at that time was 100,000 yuan per ton. However, calculating from the ore ratio, the price amounts to about 180,000 yuan. When transportation charges and miscellaneous expenses are added, it runs up to about 200,000 yuan. It is believed, therefore, that the production cost of steel ingot, after going through the pig iron and steel manufacturing process, cannot be compensated by the price of 600,000 yuan per ton. It is said that the deficit sustained as a result of the foregoing method of calculation was borne by the finance of the Central Government. In other words, since the sale prices are established by the state, any deficits in production expenditure sustained by enterprises which are behind in their rationalization program are compensated by the state. This example was reported in the process of this survey, but there seems to be some doubtful points in the foregoing information in regard to enterprises which operate under the economic accounting system or the self-supporting accounting system.

c. Cost plan

(1) Classification of cost plan

Cost plan consists of the following four principal plans

(a) Products cost plan

(b) Indirect expense plan

(c) Products total cost plan

(d) Comparable products cost lowering plan

The products cost plan is the cost plan by types of products produced by the works. This plan includes the unit cost by products and the total cost, and also the shop cost, plant cost, and the iron and steel works cost (products sales cost) of products. The planned total cost is the product of the planned unit cost and planned volume of output.

The indirect expense plan covers the total indirect expenses of the entire works and also the indirect expenses of various plants and shops. Since the greatest factor in lowering the cost lies in the lowering of the indirect expenses, the indirect expenses plan is very important. Consequently in drafting this plan, various policies connected with cutting down the consumption of goods, improving the labor organization, rationalizing management, controlling non-productive expenses, etc must be carefully studied. In addition, these policies must be concretely woven into the enforcement plan. The planned indirect expenses are proportionately added to the planned cost of various products by the prescribed method.

The products total cost plan is the combined plan of expenses required in the production of all the products put out by the various plants and shops. The basis for the compilation of this plan, therefore, is the cost plan of the various products. The products total cost plan, however, is not simply the sum total of the various products cost plans; but it is what remains after deducting the internal duplications from the sum total. In other words, this plan eliminates duplicate calculation of products in the various shops and gives the absolute total amount of expenses needed to produce the products.

The products total cost plan indicates what the make-up of the various costs for all the products is to be, and at the same time it also indicates what the make-up of the mutual costs of the various products in the various shops is to be. Therefore, the products total cost plan not only indicates the absolute total amount of expenditure for carrying out production at the various plants and shops, but also systematically points out the relationship between the production results of the various products. This becomes an important reference data when drawing up the financial plan.

The comparable products cost lowering plan is a plan for lowering the production cost of products which have been produced by this works in the past. Comparable products refer to products whose planned production cost can be compared with the actual production cost of the past based on production experience. On the other hand new products that have never been produced in the past and on which no comparison or study can be made in regard to production cost within the limits of experience are called non-comparable products. Sheet rolling at this mill in 1953 is an example of this type of production. Since there was no past production results, it is reported that a planned cost for this operation was very difficult to formulate. Moreover, the cost lowering plan cannot be materialized because there is no cost data of the past that this operation can be compared with.

Note: It is reported that there are more rigid conditions governing the stipulations on comparable products, but details are unknown.

(2) Drafting of the cost plan

Drafting of the cost plan is based on the planned cost of individual products. The procedure in determining the planned cost is generally as follows:

(a) Under the instruction of the Central Government authorities the various plants within the works make a detailed calculations of raw materials and labor required for various products and expenses of various items based on the production mission during a fixed period (annual or quarterly), the manufacturing

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method of various products, materials, labor and other already established norms, and the concrete productive conditions of this works during the said period. The results of this calculation are distributed to the workshops which in turn submit these results to the workshop teams where they are openly discussed. Revised opinions are drawn up based on the results of the discussion and the opinions of the higher authorities, and are submitted to the plant authorities.

(b) The plant authorities take into consideration the opinions of the various shops and that of the higher authorities and decide the planned cost of various products for the period concerned. These costs are entered in the planned cost table and various appended tables and submitted to the works authorities. The works authorities examine these costs and ratify them. The costs ratified by the works authorities become the final planned cost of the works and orders are given to the plants to strictly abide by this planned cost.

(c) In the course of drafting the planned cost, the indirect expenses plan and the comparable products cost lowering plan are also drafted. These are woven into the products cost plans which are further collectivized as the products total cost plan.

(3) Cost control

Cost control is the control and supervisional duties involved in guaranteeing the realization of the planned cost. These duties are enforced under the principle of rewards and punishments. That is to say, any works, plant shop or team which has succeeded in realizing the planned cost or succeeded in lowering the actual cost below the planned cost is given an appropriate award after the data have been checked. This award is separate from the awards given for suggestions on rationalization or results of competitive production.

On the other hand any works, plant or shop which failed to realize the planned cost must pay indemnity or be subject to penal regulations.

(a) Responsibility and burden of the works

1 Authorities of the works are responsible for guaranteeing that the plants carry out their regular production missions.

2 Authorities of the works have the responsibility for supplying the various plants with the necessary materials (including quality, quantity and term), wages and expenses as stipulated in the plan.

3 Losses owing to rise in cost occurring from not fulfilling the two foregoing responsibilities are borne by the authorities of the works.

(b) Responsibility and burden of the plant

1 The plant authorities are responsible for setting up the operation, carrying out production, and accomplishing the manufacturing duties in the prescribed time as indicated in the plan. They are also responsible for guaranteeing that the planned cost will not be exceeded.

2 The plant authorities are responsible for making a detailed estimate of the cost and submitting this estimate to the works authorities within the prescribed time.

3 Losses incurred in connection with the cost because of neglect in carrying out the two foregoing responsibilities are borne by the plant authorities. The losses are deducted from the profit or fund of the plant. The responsible section chief or persons are subject to punishment.

(c) Responsibility and burden of the shop

1 The shops are responsible for arranging and utilizing such items as machinery, labor and materials as planned, accomplishing the shop's plan within the prescribed time, and insuring that the planned cost of the shop is not exceeded.

2 The shops are responsible for compiling the statistics of the principal cost and submit a report to the plant authorities within the prescribed time.

3 Losses incurred in the cost because of neglect in carrying out the foregoing responsibilities are assumed by the shops. The responsible persons of the shops are subject to a set punishment. In addition the workers who carried out the work in question must pay a fixed indemnity in accordance with the collective agreement.

Generally, regulations on cost control are drawn up based on the actual situation at the works, plants and shops. Details on the regulations adopted at works are unknown.

F. Management By Fixed Standards

1. Significance of management by fixed standards

Management by fixed standards is the basic method utilized by socialistic enterprises in enforcing planned management. Therefore, the above method can also be said to be the basis for carrying out the economic accounting system. As previously related, the economic accounting system itself is the basic system for the planned management of socialistic enterprises. Its requisites lie in the production of a prescribed quality and quantity of products within a prescribed period with prescribed facilities, capital, labor, raw materials, fuel, motive power and technique. These prescribed facilities, capital, labor, raw materials, technique, and quality and quantity of products are called "fixed standards". The prescribed technique is called "fixed technical standard", the prescribed capital is called "fixed capital", the prescribed amount of raw materials is called "fixed raw materials", and the prescribed output is called "fixed output". The economic accounting system, therefore, can also be said to be a system for carrying out planned management based on these "fixed standards". Management by "fixed standards" refers to the guiding, supervising and managing of the enterprise by "fixed standards" so that production and management can be enforced most efficiently.

2. Types of fixed standards and contents

The so-called "fixed standard" in Communist CHINA corresponds to the "norm" in the USSR. The word "norm" is generally used in such terms as "work norm" and "production norm". Besides the production and work norms, however, norms (fixed standards or basic figures) are established for capital, facilities, labor, raw materials, technique, quality of products and others. The system is set up so that the total accomplishment of these norms would amount to the total accomplishment of the plan.

Basically, fixed standards can be largely divided into "fixed technical standard" and the "fixed economic standard". The "fixed technical standard" consists of the fixed quality and quantity of products, the fixed productive efficiency of machinery and the fixed productive efficiency of labor. The "fixed economic standard" consists of the fixed rate of consumption of raw materials, the fixed amount of raw materials that can be held in storage, the fixed required labor power and average basic wage, fixed rate of miscellaneous losses of raw material, fixed

amount of liquid fund, fixed amount of management expenses, fixed rate of depreciation, and fixed amount of various other expenditures. The combined form of these two basic groups of "fixed standards" is called the "fixed technical and economic standard".

Fixed technical and economic standard

"Fixed technical standard" group — "Fixed economic standard" group

The "fixed technical standard" is mainly composed of basic figures related to productive efficiency, and the "fixed economic standard" is mainly composed of basic figures related to production cost. It is desirable, therefore, that the "fixed technical standard" be raised and the "fixed economic standard" be lowered. In other words, a fundamental requisite is that the fixed technical standard be set at a much higher level of productive efficiency through the improvement and rationalization of facilities and the improvement in technique and operational method. Another fundamental requisite is that the fixed economic standard be set at a much lower level of production cost through the improvement and rationalization of the economic phases of management. These requisites, however, must be conditions that can be actually carried out.

The principal items of the "fixed technical standard" enforced at this works after 1953 and their various related indexes that have been clarified are as follows:

Note: It is reported that these items and indexes are indicated in detail in the "Statistics Regulations" drawn up and made public by the Finance and Economic Committee of the Central Government in 1952. The entire content, however, are unknown.

a. Calendar days: 365

b. Number of hours: 365 x 24 hours

c. Number of hours of cold repair: number of days for cold repair x 24 hours

d. Prescribed hours of operation: (number of calendar days - number of days for cold repair) x 24 hours

e. Number of working hours: prescribed hours of operation - number of hours for hot repair

f. Effective utilization index of various facilities

(1) Blast furnaces:

$$\frac{\text{Effective working volume}}{\text{Daily output (tonnage of pig iron output)}} = \text{number of cubic meters per ton per day}$$

(2) Open-hearth furnaces:

$$\frac{\text{Daily output (tonnage of steel output)}}{\text{Effective hearth area}} =$$

number of tons per square meter per day

(3) Electric furnaces:

$$\frac{\text{Daily output (tonnage of steel output)}}{\text{Transformer capacity 1,000 kva}} =$$

number of tons per 1,000 kva per day

(4) Rolling:

$$\frac{\text{Daily output (tonnage of rolled products)}}{\text{Working hours}} =$$

number of tons per hour

(5) Operating rate: $\frac{\text{Number of working hours}}{\text{Number of hours}} \times 100\%$

(6) Effective operating rate:

$$\frac{\text{Number of working hours}}{\text{Prescribed hours of operation}} \times 100\%$$

(7) Recovery rate: $\frac{\text{Effective output}}{\text{Total output}} \times 100\%$

Note: In regard to the production of steel, total output corresponds to the amount of steel tapped, while the effective output corresponds to the amount of steel ingots produced.

(8) Percentage meeting specifications:

$$\frac{\text{Amount meeting specifications}}{\text{Amount meeting specifications + amount rejected}} \times 100\%$$

(9) Yield of raw materials:

$$\frac{\text{Total output}}{\text{Amount of raw materials charged}} \times 100\%$$

(10) Index of peak months of production: arithmetic mean value of peak months of operation

(11) Superior index: medium progressive value

Note: Medium progressive value will be explained separately.

3. Method of indicating the productive capacity of facilities

Some explanation will be made on the method of indicating the productive capacity of facilities because this method seem to have an important relationship with "fixed standards" and with the execution of "management by fixed standard".

a. The rated capacity and actual capacity generally used to indicate the productive capacity of facilities.

b. As it is in the case in JAPAN, the rated capacity is indicated by the designed capacity of an equipment within a unit time. However, its determination is based on a purely technical calculation, and does not take into account the interests of the management and political considerations, as it is done in JAPAN.

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In regard to the former Japanese-controlled facilities which were confiscated by the Chinese Communists, however, the former rated capacities were still used regardless of whether these facilities were improved or not. In extreme cases, therefore, there are times when the actual production is many times more than the rated capacity. It is said that this measure is mainly taken for propaganda purposes in relation to production efficiency. Indication of the rated capacity in such cases has no rationality from the standpoint of technical engineering.

c. The actual capacity is commonly used as the standard of capacity from the standpoint of practical business. Drafting of plans, and determining of the fixed standards are based on the actual capacity. Determination of the actual capacity is based on a very rational calculation by studying the actual conditions of the facilities (including the attached facilities) and conditions of operation and management at the time of determination.

In the case of blast furnaces, calculation of the daily output is based on the effective working volume and the effective utilization index, and the annual output is calculated by multiplying the daily output with the operating rate (number of operational days throughout the year) during normal operation. In this case, the number of working days is calculated by periods (by quarterly periods), and the number of days in a non-working period is not calculated. Basic constructions and major repairs of facilities are generally planned so that they will be completed by the end of each period so that normal operation can commence from the start of the following period. Therefore, the actual capacity of facilities, which is traditionally made public by the Chinese Communist authorities at the beginning or the end of the year, is generally closer to the actual production of the new year and is not appropriate in judging the production of the preceding year.

The number of days required for major repairs is always subtracted from the number of working days of the year in which the major repairs are carried out. The Japanese method of allotting the same number of days for repairs to each year of the blast furnace's life is not adopted. Therefore, the indicated annual productive capacity of the same blast furnace greatly varies depending on the year.

4. Establishment and improvement of the fixed standards

The fixed standards indicate the standard quantity for facilities, raw materials, labor power, operating rate and various expenses, and at the same time indicate the absolute required standard quantity for accomplishment of the plan. The fixed standards, therefore, must be attained without fail and the basic requisite calls for the constant display of an efficiency higher than the fixed standards. In the case of the fixed technical standard the basic requisite lies in exceeding the fixed standard, and in the case of the fixed economic standard the basic requisite lies in accomplishing the established production mission with expenses lower than the fixed standard.

These factors must be basically taken into consideration when establishing the fixed standards. For example, in the case of the fixed technical standard, the fixed standard must not be established at too low a level where it could be easily attained, or at too high a level which would make it unreasonably difficult to attain. In the case of the fixed economic standard, it must not be established at too high a level which would invite a plethora of expenses, accumulation of raw materials,

waste, and a drop in the turnover of the liquid fund; or at such a low level which would make it difficult to accomplish the established production mission.

In other words, the fixed standards must be sufficiently rational and at the same time be practical. Moreover, they must be established so that expansion and reproduction can be normally promoted through their accomplishment. The fixed standards, therefore, must be renewed yearly and periodically, and with each renewal, the new fixed standards must be an improvement over the previous ones. The fixed standards of the past reflect the productive conditions of the past. If the fixed standards are permanently established, there is a fear that this would obstruct the development of production and progress in management. The fixed standards, therefore, are established and revised with the aim of progressively improving the fixed standard itself.

a. Medium progressive fixed standard (or average advance fixed standard)

Owing to the foregoing reasons, the establishing of fixed standard is based on the "principle of medium progress" (or "principle of average advance"). The fixed standard decided by this principle is called the medium progressive fixed standard or average advance fixed standard.

In regard to the method of establishing the fixed standards, there are cases when it applies only to one enterprise and when it applies also to other enterprises of the same department.

When establishing the fixed standard that will apply only to a certain enterprise, the arithmetic mean value of the fixed standard which was actually accomplished by the enterprise concerned in the past must be obtained. The fixed standard of actual results higher than this value is called superior fixed standard (or advanced), and the arithmetic mean value of the superior fixed standard is the medium progressive fixed standard (or the average advanced fixed standard).

When establishing the fixed standard applicable also to other enterprises of the same department, the arithmetic mean of the fixed standard accomplished by the various enterprises in the past is obtained, and this is called the average fixed standard. Enterprises that have shown a fixed standard of actual results that is higher than the average fixed standard are called advanced enterprises, and the fixed standard attained is called the advanced fixed standard. The arithmetic mean of this advanced fixed standard is the average advanced fixed standard or the medium progressive fixed standard.

In other words, with the average fixed standard (or medium fixed standard) as the minimum, the fixed standard is determined as the mean value of the fixed standard of actual results which are higher than the minimum.

b. Efforts in approaching the model fixed standards

Efforts to approach the model fixed standards are the keynote in the method related above. The ultimate goal of the model fixed standards is to approach or to attain the level of not only the advanced fixed standards of the works or the state but also of the international fixed standards. Especially after 1952 when the Soviet system was wholly adopted for the planned management system, the advanced fixed standards

of the USSR have been considered as the highest model and the goal of the future was to catch up with or surpass these standards. Actually, however, the present goal is in the concrete realization of a superior fixed standard of actual results by each works throughout the country and all efforts are being concentrated on placing this fixed standard on a common level throughout the country.

5. Various measures for attaining the fixed standards

a. Strict enforcement of the work progress schedule

For example, at the end of the first quarter of 1953, the steel manufacturing department of this works had three open-hearth furnaces in full operation and the steel output was close to 12 charges a day, but there were only two charging cranes and a 50-ton ladle crane in operation. Moreover it was very difficult to process steel ingot with four ingot casting pits (20 molds whose firebricks are replaced with each casting) and two ingot cranes.

In such cases, therefore, if the tapping time of each furnace is not appropriately regulated, the crane may not be available or the ingot casting pit may not be properly prepared even though the charge is ready to be tapped. The tapping time will thus be delayed, and the efforts to reduce the steelmaking time will be of no effect. Moreover, changes might take place in the quality of the steel and bring about a great disadvantage in attaining the fixed standard.

As a countermeasure, a detailed work progress schedule comparable to a train timetable is made and the planned work at the workshops is carried out according to this schedule. If the work progresses exactly according to the work progress schedule, the fixed standard can be attained. Therefore, the work planning supervisor keeps a record of the work progress at all times and cautions the men in charge of the open-hearth furnaces to conform with the progress schedule.

b. Work discussion meeting

After the day's work all members of each shift (three-shift system) gather and hold a discussion concerning the day's work. They mutually criticize the shortcomings and endeavor to make improvements on the next day's work. The results of this meeting are notified to the person in charge of the next shift who in turn imparts these results to the workers under him.

At the steelmaking plants, the discussion is centered on cutting down the steelmaking time and even a reduction of one or two minutes is fought for. When the actual time exceeds the planned progress time the cause is thoroughly analyzed and discussed and the findings are reported to the management.

To a layman it would seem that the most efficient and simple way of reducing the steelmaking time is to greatly reduce the charging time which requires about two hours. This, however, is not necessarily easy considering the conditions of the equipment, the workshop, etc. In short, there is no other way in reducing the time except to reduce a few minutes from each phase of work throughout the entire process from charging of raw materials to tapping and thereby raise the overall efficiency. Subjects of discussion at the meeting, therefore, include even the minute working movements.

c. Work commitment and general conclusion

The work commitment shows in definite figures the various goals to be realized by the operation of the various work sites and announces these figures within and without the works. The general conclusion elucidates the collective conclusions of the work results. Originally the work at the work sites is stipulated by the work plan which was decided through open discussion among all the workers at the work sites. Therefore, the accomplishment of the plan is not merely the carrying out of orders from superiors but is based to a certain extent on each worker's own sense of responsibility. The commitment is announced on the basis of this sense of independence and the responsibility system, and all efforts are made to accomplish this.

Taking the raw material shop as an example, the work goal is elucidated and commitment is made by establishing conditions calling for the removal of poor grade ores through rigid sorting of sizes and strict adherence to specifications based on the fixed standard of raw materials to be charged. After putting the commitment into practice, a general conclusion meeting is held once every month to discuss the results. The results are classified into success or failure and announced. On this occasion, the specifications, sizes and the amount of work done are all explained in figures. Commitments are not only announced to the various workshops within the works, but are also made known to the plants and workshops of affiliated works so that they can cooperate in realizing the commitments.

d. Reward system

Various reward systems are adopted for attaining or surpassing the fixed standards. Selection of workshops or individuals to receive rewards is carried out on a wide scope and in close connection with the daily work affairs. Official commendations such as minor merit, major merit, workers' model and workers' hero are given depending on the achievements. There are cases when awards are given to individuals or to work units such as teams, shops and plants. This system was enforced from early 1950, but recently the rewards are given mostly to the workshop organization as a unit.

The method of rewarding is similar to that of other works as previously related. The rewards consist of conferment of certificate of honor, payment of additional allowance and prize money, presentation of pennants, invitation to health-resorts and theaters, participation in the national holidays and mentioning in newspapers, radio, magazines, bulletin boards and others. Workers who are thus honored are indirectly given the chance of a raise in pay, a promotion, recommendation to enter a staff school, studying abroad in the USSR, and being selected to become a member of the Chinese Communist Party. Because of the foregoing reasons, this system appeals to and is especially welcomed by youthful workers who believe this is their opportunity for promotion.

The Chinese Communist Party plans the award presentation function on a grand scale every year as a regular festival. Workers' heroes and workers of model workshops march through the works and the streets in formation lead by a band. They are greeted by the ovation of workers of other workshops and the works. The people are energetically instructed by the Party to praise this group.

e. Penal regulations

In contrast to the elaborate reward system which is in effect, various realistic penal regulations are applicable to individuals and workshops that do not attain the fixed standards. As related in the paragraph dealing with cost control, the individuals, workshops, plants and works which cause losses to the state by not meeting the fixed standards must compensate the losses without fail. In these cases, such punishments as reduction in wages, reduction of budget, suspension of raise in wages, reprimands, demotion, and dismissal are also meted out. Even those who cause a loss to the state through a simple mistake are subject to punishment. These mistakes are divided into major and minor error and are offset by major and minor merits. In other words, a major merit attained in the past will be cancelled by a major demerit. Consequently if a worker with no record of merits in the past commits a major or minor error, he must compensate for it by performing a major or minor meritorious deed. It is said that those who do not receive such materialistic punishments as reduction in wages or fines will suffer a far greater punishment through social sanction by becoming the target of public criticism in the workshop, in affiliated groups and among associates.

6. Principal factors in improving the fixed standards

This section will deal only with principal factors in improving the fixed standards of the steelmaking process at this works at the end of the first quarter of 1953.

a. Reduction in the steelmaking time

As previously related, emphasis is placed on reduction in the steelmaking time in improving the fixed standard at the steelmaking site. For this reason each process from charging of raw materials to tapping is clearly differentiated and each process is carried out under a rigid responsibility system. Since increase in the frequency of tapping is the basic factor in increasing the steel output and an important factor in raising the effective utilization index of the furnace, reduction in the steelmaking time becomes the most important issue. All the workers read the "Rapid Steelmaking Method" (translated into Chinese) which is said to have been written by a Soviet workers' model, and also engage in joint research during the study hours to acquire the new working method. On the other hand, management personnel of the works are directing strenuous efforts to raise the workers' will to work by showing sketches, giving oral explanations or propagandizing the fact that reduction of a minute in the steelmaking time would mean an increase of so many tons of steel in a year.

b. Increase in the steel output per heat

The daily output at the steelmaking site is the product of the number of tappings per day and the amount of steel output per tapping. Therefore, in planning to increase the daily output, it would be most natural to concentrate on increasing the steel output per tapping. The actual condition at the end of the first quarter of 1953, however, was that the steel output per heat had to be restricted at this works due to the delay in the arrival of a 70-ton ladle crane ordered from the USSR. At that time, therefore, over-charging of the furnace was inconceivable. Installation of a new crane, however, was already woven into the basic construction plan of 1952 and the arrival of the necessary facilities from the USSR was to be materialized in the near future. For this reason, overcharging of the furnace would naturally be considered after installation has been completed.

c. Lengthening of the life of a furnace

Lengthening the life of a furnace is also one of the important factors in improving the fixed standards. In order to lengthen the life of a furnace, research and improvements are being made on the quality of steel, firebrick, fireproof filling materials, heat control and methods of repair. In addition, measures are being taken to lengthen the actual life of a furnace by raising the operating rate of the furnace through reduction of non-operating days caused by hot and cold repairs. For example, the adoption of the rough Soviet method of removing solidified slag with dynamite is reported to be showing good results in reducing the time required for repairing furnaces.

d. Improvement of the thermal efficiency

It was after the overall adoption of the Soviet operational system in late 1952 that the problem of thermal efficiency came to the fore. The basic issues involved were the lowering of the fixed standard for raw material consumption and the fixed standard for cost. At the end of the first quarter of 1953, therefore, a university-graduate apprentice technician was placed in charge of measuring the temperature of the regenerator and in devising measures for improving the thermal efficiency.

e. Improvement of quality

Improvement of the raw material mixing ratio was strongly demanded as a method to improve the fixed standard of quality and quantity. When the 1953 Plan was drafted, the raw material mixing ratio was specified by the central authorities. Prior to this specification by the central authorities, the raw material mixing ratio adopted by the steel manufacturing department of this works was 10 per cent scrap steel and 90 per cent pig iron. However, this ratio was altered to 25 per cent scrap steel and 75 per cent pig iron by the central authorities. This order was issued as a concrete measure connected with the quality-improvement movement of 1952. However, such measures as that for the improvement of the quality of pig iron and that for rigid selection of scrap steel preceded issuance of this order.

In regard to such measures as these, there were only a few cases in the past where the central authorities issued orders consisting of concrete figures. At that time, there was a tendency among the various works to lay emphasis on mass production and to neglect improvement in quality. Therefore, it is believed that such orders as these were issued to remedy this undesirable practice. The specified raw material mixing ratio conformed to the national pig-iron supply and demand plan for 1953 and had to be strictly observed and carried out as a non-variable figure.

As measures for improving the quality, rapid analysis prior to charging of the furnace and pickling tests after the ingots are cast were carried out. Moreover preparations had been made for the construction of a new mixer. The construction of a new mixer was being planned since 1951 to keep up with the improvement and new construction of open-hearth furnaces, but it was postponed from the order of importance of construction. It seems that materialization of this construction plan was accelerated along with the urgent demand for improvement in quality.

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G. Working Conditions

1. Work system

a. Work shift system

(1) Most of the work sites operate with three work shifts a day.

Note: The two-shift system was used before Chinese Communist control.

(2) Most of the office workers worked only during the day.

Note: This is the same as before Chinese Communist control.

b. Working hours for each shift

(1) Actual working hours is eight hours (includes short rest periods)

Note: There is no time set aside especially for lunch. Workers have lunch at the work site at their own discretion.

(2) Preparation time for changing shifts (one hour)

There is a one-hour preparation time for changing shifts besides the actual working hours. During this hour, the operation is taken over by the incoming shift and pertinent information are relayed. Workers of the outgoing shift minutely explain the operational conditions, hold necessary discussions, and thoroughly impart precautionary matters to the workers of the incoming shift.

c. Study hours

There are two hours of study a day, twelve hours a week. Shop workers' classes are held outside working hours and clerical workers' classes are held during working hours.

Note: Consequently, the actual portal-to-portal working hours of the shop workers is eleven hours a day.

2. Operational setup

The operational setup is established on the bases of the highly developed specialization system and the responsibility system, according to the Soviet-type operational regulations.

No matter what the duty, there is always someone responsible. Each worker has a fixed job for which he is responsible. Take an open-hearth furnace operator for example. His duties are clearly fixed as the "open-hearth furnace number so and so operator".

The duties and sphere of responsibility of each worker in charge of labor, operation, and raw material are always clearly defined. A special feature is the perfectly organized machinery maintenance setup.

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The three functional fields of inspection, care, and repair are organized so systematically that they are ready to take immediate actions in perfect coordination. Chart No 10-68 shows the operational setup of the steel manufacturing department of this works.

H. Operational Regulations

1. Circumstances surrounding compilation of the regulations

After the Chinese Communists took control, the biggest problem that this works faced was how to raise the operational efficiency with the existing shortage of technicians and skilled workers. The operational regulations, which may be referred to as this works' laws governing operations, were compiled to cope with this situation. The Chinese Communists started drawing up the operational regulations soon after they took control. At first, they assigned the task of supervising the compilation of the regulations to Japanese technicians. Subsequently, they embodied the experiences of other plants which copied the advanced working methods of the USSR and the working methods devised by the labor heroes, thus gradually revising and improving the regulations. The present regulations were first finalized with the complete adoption of the Soviet operational method in summer 1952. These operational regulations were immediately printed and distributed to each worker in the production departments. Up to the end of the first quarter of 1953, no revisions had been made in the regulations.

2. Organ in charge of drawing up the regulations

Each works has its own operational regulations. They are drawn up to conform to the existing facilities of each works. At the Tai-yuan Iron and Steel Works, the Production Technique Section of the Production Office was the organ responsible for drawing up the regulations.

3. Form and contents

The operational regulations are printed as independent booklets for each department in production. The booklets are the pocketbook type, and their size is 15 centimeters by 15 centimeters and is three to four centimeters thick. These booklets were prefixed with their department names and called "Blast Furnace Operational Notebook," "Open-hearth Furnace Operational Notebook", or "Rolling Operation Notebook"

Contents of the booklets correspond to the operational regulations. The standard operational method of each department is printed in simple language in full detail. These booklets are so designed that they enable workers of each department to at least carry out their work according to standard despite the difference in the degree of the individual worker's skill. In these handbooks operational methods are minutely divided and highly specialized and standardized with a view to adapting even the relatively unskilled workers to the organized mass production.

4. Handbook on steel manufacturing operations (one example)

A portion of the text of the "Handbook on Steel Manufacturing Operations" of this works is presented in the following page. The following actions, methods and precautions pertaining to open-hearth furnace operator and his assistant are set forth specifically and in detail in the paragraph dealing with the open-hearth furnace operation.

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a. Actions at time of tapping

b. Method of scraping out residue after tapping

c. Method of checking for irregularity in the hearth

d. Method of determining type of fillers for erosion-caused hole in the hearth according to length (millimeter), width (millimeter) and depth (millimeter) of the hole.

e. Order and method of charging raw materials, and temperature changes at the time

f. Operations subsequent to charging and during melting time

g. Method of blowing in compressed air

h. Method of refining

i. Chemical composition of molten steel and amount and time allowed for charging of fluxing and other agents

j. Other miscellaneous operations

These actions and methods are described in detail down to the slightest movements of the workers concerned. Take for example the procedure for extracting samples from inside the furnace during the time of steel manufacture. The movements of each worker are prescribed as follows:

a. A certain number assistant will extract a sample from a designated spot of the furnace with a dipper

b. A certain number assistant will help this operation from a designated position and in a designated manner.

c. The furnace foreman will examine the sample in a designated manner with the supervisor.

d. After consulting with the supervisor, the furnace foreman will determine how much lime is to be used and point out the place to be repaired.

e. The furnace foreman will point out the place to be repaired by throwing in the first scoop of lime to that place.

f. Assistant No 1 will take a scoop of lime from the designated lime pile, advance so many steps and throw the lime into a designated direction inside the furnace. He will then turn so many degrees and procede to the lime pile.

g. Assistant No 2 will ... and throw the lime into a designated direction inside the furnace.

h. Assistant No 3 will ....

All these movements are materially set forth in proper order and are so arranged that they combine to form integral parts of a flawless assembly line system of operation.

In addition to what has been described previously, points to be strictly adhered to, such as the classification and method of furnace repair, and the rising curve of furnace temperature following cold repair are all clearly written down. Also, actions of and precautions for the workers concerned in regulating the furnace temperature and measuring the temperature inside the regenerator are set forth in detail and in concrete form.

I. Various Measures to Increase Production

The improvement and increase in facilities, the supplying of raw materials and the raising of the quality of products, the planned control of management and production, and the various steps taken to regulate and specialize the operations in workshops, all of which have previously been covered, are all directly connected with the measures to increase production. In fact these very measures may also be regarded as basic measures to increase production. However, only those measures developed by this works which directly involved the workers and those related measures which are believed to be important are outlined below.

1. Promoting the workers' will to produce

Such measures to appeal to the workers' material interests and love of fame as the bonus system, various reward system and welfare measures, and such measures to appeal to mental enlightenment as political and ideological indoctrinations and various studies are skilfully interwoven and developed as measures for promoting the workers' will to produce.

In regard to the bonus system, measures such as payment of additional wages, increase in wages and promotions, issuing of snacks, and establishing of the minimum wage according to production results have been put into effect. The actual pay is said to be three times what it was during the postwar Chinese Nationalist era. Additional wages are paid to workers who produced more than the norm and the amount paid depended on the degree to which the norm was surpassed. Since the beginning of 1951, snacks have been given to all workers. Each worker is given two go of milk and one small rice-cake (10 centimeters in diameter and three centimeters in thickness) every day. The bonus system will be explained later in detail.

The reward system will not be re-explained here, since it has already been covered. The welfare measures will be explained later, but their perfection is expected through the enactment of the labor insurance system, perfection of hospital facilities, additional construction of workers' housing, and the expansion and equipping of schools, consumers' cooperatives, nurseries, and cultural and recreational facilities. For example, in the application of the workers' insurance, considerations are given according to the work accomplishments of each individual worker. In allotting housing, priority is given to the workers according to their work history and achievements. The workers' union chiefly operates these welfare facilities maintaining a close liaison with the administrative authorities. A full-time union worker or a progressive element is assigned to each workshop to observe the working conditions and work achievements of the workers. Thus measures are adjusted so as to contribute toward production increase.

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Political study is designed to give basic understanding of the policies of Communist CHINA. The aim of these political studies is to convince the workers that they are the masters of the state and plants, that prosperous development of the state and factories is the basic requisite for bettering the position and livelihood of the workers, and especially, that for the workers to exert efforts for production increase brings prosperous development to the state and plants and is the shortest way to raise the position and livelihood of the workers.

It is so designed that by constantly and adequately imparting these material, and spiritual incentives to the workers, their enthusiasm toward production is retained and the necessary spiritual elements such as their positiveness, creativeness, independence and sense of responsibility are constantly strengthened.

2. Movement to set new records

This movement was developed on a national scale. Since its meaning and particulars have already been generally described in other chapters, they will not be repeated here. This movement was started at this works in summer 1950, about a year after the plants in the Northeast Area started the movement. Plants and workshops that set new records are given public recognition as model plants and workshops and awarded various types of prizes. These plants study and analyze the various conditions under which the new record was set. The results are published and made known to every worker. This helps in measures to increase production in the various plants inside the works, and at the same time, instigates and promotes the setting of even higher new records. New records of national level are commended and publicized in the official bulletins of the Iron and Steel Industry Control Bureau of the Ministry of Heavy Industry so as to lead various enterprises throughout the nation to set even higher records by following suit and raising the production level.

3. Dissemination of technical knowledge and idea suggestion

This subject will not be explained in detail here, since it is about the same as those already covered under other chapters. The dissemination of technical knowledge and idea suggestion were begun to be conducted actively from about spring 1951 following the development of the movement to set new records. Inasmuch as the various circumstances and reasons for setting new records are analyzed and made public as related above, the dissemination of technical knowledge is inevitably promoted. The working methods in the various workshops are always closely studied and the results are posted inside the plants, hence the ready spread of the work methods. The excellent achievements of other works and the conditions and methods that made the achievements possible are always reported. The present Soviet working methods and advanced technique are taught and propogated by Soviet specialists. Therefore, new knowledge on working methods is adopted as much as possible, and past practices of not making techniques public and the old guild-type practice of handing down technical skills from father to son have been completely eliminated.

4. Patriotic movement to increase production

This movement was developed as a part of the so-called "Resist-US-aggression-aid-Korea" Movement after Communist CHINA entered the Korean War and was at its height in the latter half of 1951. This movement generally tended toward quantitative increase in production and

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was accompanied by ill effects such as rising of costs and the lowering of the quality of the products. The facilities at the time were generally superannuated, and the improvement or additional construction of facilities were either not started or started but unfinished. Therefore, the increase in production had to be realized through the maximum use of the existing facilities. Actually, the facilities were exerted beyond their limits. As a result, the renovation of facilities had to be performed earlier and caused the loss of commercial profits and the lowering of the quality of products. The increase in the congestion of goods due to the unplanned purchase of raw materials and the inadequacy in management greatly impeded the circulation of liquid funds.

5. Cost reduction struggle

The question that naturally arose as a result of the abovementioned movement for production increase was to reduce cost and to economize on various expenditures. The movement to reduce costs was launched actively from late 1951. Increase in production was still a basic requisite at this stage. Consequently, the movement for production increase was continued as a new production-increase and economizing movement with higher administrative and economic significance. Information concerning the strict enforcement of cost accounting following this stage, the perfecting of the cost accounting system, cost planning and cost control, and the strengthening of control over various indirect expenditures, manpower, and raw materials has already been generally described, therefore it will be omitted here.

6. Movement to improve the quality of products

From spring 1952, a movement to improve the quality of products was launched on a nationwide scale as a countermeasure for one of the ill effects that accompanied the patriotic production-increase movement. In the course of the movements for setting new records and for increase in production, unexpectedly good results were attained in quantitative increase in production but many problems arose with respect to the quality of the products. For example, many claims were made on this works when the billets sent to TIENTSIN and the wire rods sent to SHANGHAI were unacceptable. As a result, criticisms and inspections on the quality of products grew severe, and the various plants and workshops began holding monthly exhibition of rejected products and making zealous efforts to find the cause for the rejects and to study ways for solving the problem. As a result of this movement, the percentage of both coke and pig iron meeting specifications was raised to more than 99 per cent; steel ingots, 98 per cent; and steel material, 99.5 per cent by late 1952.

7. The Antirevolutionary Suppression Movement, the Three-anti Movement, and the Five-anti Movement

Essentially the Antirevolutionary Suppression Movement, the Three-anti Movement, and the Five-anti Movement were not necessarily concerned directly with the measures for increasing production. However, from the standpoint that all three eliminated the conditions that hampered production increase, they can be said to have played an important role in increasing production.

The Antirevolutionary Suppression Movement was developed at this mill from autumn 1950 to spring 1951. During this period the "misdeeds" committed by the leaders during the Chinese Nationalist era

were brought to light one after another and these leaders were generally punished for some reason or other and fired from their positions. Leaving aside the propriety of the purge, the fact that positions of management staff personnel of this works were occupied by leading Chinese Communist elements on the occasion of this movement may be said to have been a preparatory action indispensable to the subsequent re-organization and consummation of management and production systems.

The Three-anti Movement was started in autumn 1951 and it was supplemented by the Five-anti Movement from early 1952. They were launched as the Three-anti and Five-anti Movement up through August of the same year. The persons in this works whose misdeeds or crimes were exposed in the course of this movement numbered about 1,000, but most of them were made to confess their crimes without being discharged and were dealt light punishment. Some of the leaders, however, received such heavy punishment as imprisonment and demotions. For example, KUO Ch'i-ying (STC 6753/1142/2019) (Party member) was the army deputy representative at the time of the confiscation of this works and was subsequently serving as assistant superintendant of the works and concurrently the chief of the construction and engineering office. He was arrested and imprisoned in the course of this movement. His successor, LI Shu-jen (STC 2621/2885/0086) and engineer CHANG Yu-lin (STC 1728/0645/2651), and advisor to that office, soon afterwards fell victims to the same movement. A certain senior engineer of the Chinese Nationalist era was punished in 1951 in an aftermath of an antirevolutionary incident. He was subsequently demoted to an engineer in charge of a blast furnace. In 1952 he was again denounced under the Three-anti Movement and was demoted to an ordinary engineer with no assignment.

Note: 1. LI Shu-jen was about 35 years old at the time. He was brought up in a very wealthy family and was thus at a disadvantage in this respect. In the Chinese Nationalist era, he was employed by the Hsi-pei Industrial Company, the predecessor to this works. After the Chinese Communists took control, he was hired for his technical skill and was appointed the first chief of the designing department. After KUO Ch'i-ying was arrested and fired in autumn 1951, LI was appointed assistant superintendent of the works and concurrently chief of the construction and engineering office. In 1952 he was involved in a scandal dealing with basic construction and was arrested. For a time he was held in the provisional jail at the works. He was released, however, in spring 1953, after which he was demoted to a common clerk in the basic construction office. LI was not a Party member, but his wife was.

2. CHANG Yu-lin was a technician who graduated from a university in BRITAIN. In autumn 1949 (he was 32 years old at the time), he was called from SHANGHAI at the request of the Central People's Government and was given the position of advisory engineer to the works. He was not a Party member. As advisory engineer of the works, he was in charge of supervising the planning and basic survey connected with basic construction. In addition, he also managed the "CHANG Yu-lin Construction Office", a privately operated civil engineering contracting firm. It was reported that the reason he was denounced under the Three-anti Movement was that in connection with construction projects of this works he passed out money lavishly to various people in the works with the idea of profitting himself. He was arrested and taken to PEKING in 1952, but his subsequent whereabouts is unknown.

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J. Labor

1. Number of workers

a. During Japanese control

In 1942 and 1943, there was a total of about 4,600 workers of whom about 600 were Japanese and 4,000 were Chinese. The 600 Japanese consisted of 50 to 60 technicians and staff personnel and about 550 associate workers (persons who engaged in actual work while supervising Chinese workers in the workshops).

b. During Chinese Nationalist control

It is not known how many workers there were during Chinese Nationalist control after the war ended. At the time, there were about 130 detained Japanese, of whom about 30 were detainees from the Peking-Tientsin area.

c. During Chinese Communist control

There were about 1,000 workers in the early days after the confiscation of the works. The number quickly increased thereafter and by the end of the first quarter of 1952, there were more than 10,000 workers, and by the end of the first quarter of 1953, there were 15,000 to 16,000 workers.

This sudden increase in the number of workers was brought about by several reasons; namely, the change from the two-shift system to the three-shift system, the use of a large number of trainees, the expansion of the scope of business, the increase in management personnel, and the new expansion and increase in personnel in the basic construction, repair, and kiln departments.

2. Number of staff personnel

There were about 2,000 staff workers at the end of the first quarter of 1953. They may be categorized into the administrative staff and technical staff personnel. The administrative staff personnel made up the vast majority. There were only about 30 Chinese workers who could be called technicians in the true sense of the word. The reason that the majority of the personnel are connected with administration seems to lie in the planned management system whereby all functions were minutely divided according to the Soviet method. Not only were these management personnel concentrated in the works' headquarters but many were assigned to various workshops with complex functions. For example, personnel affairs, secretarial, accounting, cost accounting, and welfare sections were set up in the plant office of the steel manufacturing department and specialized management personnel were assigned to each section.

3. Skilled workers

The skilled workers at this works are composed of persons who have acquired their skill from the Japanese technicians since the Japanese era, and these senior technicians constituted the propelling force behind the operations in workshops except for departments which had been newly set up after the Chinese Communists took control.

These skilled workers are comparatively few in number, making up only about 10 per cent of all the workers in each department. After the Chinese Communists took control, however, owing to the mechanization, standardization, simplification, and subdivision of operations brought about by the adoption of the specialization system and operational regulations, the need for skilled works in the original sense of the word has been gradually decreasing, and the number of skilled workers for the standardized, specialized, and simplified operations has been increasing.

Note: In spring 1952, there were about 70 skilled workers in the pig-iron manufacturing department. The nucleus of these 70 were the 10 workers who came from the Pen-ch'i-hu Coal and Iron Company in 1938.

4. Position classification system

a. The workers are divided into office and shop workers.

b. The office workers are divided into those in the technical field and those in the administrative field. These workers are again divided into various specialized positions.

c. Office workers in the technical field are divided into four classes; namely, engineer, senior technician, technical worker, and apprentice technical worker. While each of the first three are divided into five grades, apprentice technical workers are not divided into different grades.

Note: Position of assistant engineer was not authorized at this works.

d. It was said that an engineer is a person who is a graduate of a university or technical school, who is capable of designing facilities, and who has a full understanding of the present conditions of world technique for the type of work in which he specializes (for example, pig-iron manufacture, steel manufacture, rolling, etc).

e. The post of apprentice technical worker is the gate-way that all aspirants for technical-field office workers must pass. Workers and graduates of universities and technical schools invariably must first serve as apprentice technical workers before they are promoted step by step to technical worker, senior technician, and engineer. University or technical school graduates, however, are promoted to engineers directly from technical workers, while persons who come up from the ranks of shop workers are promoted from technical worker to senior technician. Senior technicians are usually those technicians who have no designing ability.

Note: 1. Up through 1952, there was a position at this works commonly called "advisory engineer." However, it is not clear whether the term "advisory engineer" was the official title of the position. The advisory engineer was the highest ranking engineer in this works. The advisory engineer was the earlier mentioned CHANG Yu-lin. Since he ran a privately operated civil contracting business, it seems that he was literally hired as an advisor to the works.

2. During Chinese Nationalist control, the engineers were divided into 36 classes. Since practically all of the staff personnel with the rank of section chief were technicians, most of them became engineers after the confiscation of the works by the Chinese Communists.

f. Details are unknown on classes and grades of the administrative-field office workers. The position classification was revised in late 1952, and grades were established even for directors of works such as director-grade one, director-grade two, and so on. At this works, the director and two or three assistant directors, including the assisant director for production, were qualified as director-grade one.

There was a position among the accounting workers called a certified accountant. However, up to late May 1953, there was only one certified accountant at the works, and he was a Japanese detainee. There were no Chinese certified accountants.

g. There were eight grades of workers from the skilled workers down to the apprentices.

5. Educational background of shop workers

Details are unknown, but very few of the workers had gone to middle schools or higher. At the end of the first quarter of 1953, there were only five graduates of middle school or higher among the workers of the rolling department of this works.

(1) Two university graduates

(2) Two industrial school graduates

(3) One middle school graduate

Note: One of the university graduates was in charge of the sheet mill.

6. Plant managers

At the end of the first quarter of 1953, the managers of the various plants of this works were generally about 30 years of age and Party members. They were generally technical-worker class technicians. Examples are given below.

a. Manager of the steel manufacturing plant

The manager was a certain CHENG (STC 6774), 27 or 28 years of age and a native of CHUNGKING. He was a Party member.

b. Manager of the rolling mill

The manager was K'O Ch'eng (STC 2688/2052) who was about 30 years old. When the mill was confiscated, he came as military representative liaison officer. He was a Party member but not a technician.

c. Manager of the sheet mill

The manager was KAO Hung (STC 7559/4767). He was 32 or 33 years old, a Party member, and a graduate of a university in the Chungking area.

7. The filling of vacancies, training, and transfer of key personnel

a. The filling of vacancies, training, and distribution of key personnel were done on a unified policy of the central authorities. Thus, even key personnel trained at this works were occasionally transferred to other works at the direction of the central authorities.

b. Vacancies, for key personnel were filled by transferring men from other works, or by recruiting workers from the general public. In the case of the latter, apprentices were recruited with the aim of training them to be leaders. This recruiting was done through advertisments in newspapers.

Note: Ordinary office workers are frequently recruited by ads in newspapers, but this survey found no instances where shop workers were recruited through newspaper ads.

c. As already stated, vacancies for key personnel in the technical line were filled by training apprentice technical workers. Of course, sometimes the positions were filled by bringing in men from other works. Apprentice technical workers were either selected from among the skilled workers or recruited from among university and technical school graduates. After the employment, these graduates must engage in actual work in workshops with the ordinary shop workers for at least six months. In spring 1952, seventeen or eighteen apprentice technical workers were attached to the pig-iron manufacturing department of this works. Every year at the school graduating season (summer), the number of apprentice technical workers attached to the various departments suddenly increases.

d. During the time that the Japanese technicians were detained (until April or May 1953), the training of the technical cadres was conducted with the aim of having the cadres learn and absorb the techniques of the Japanese technicians. As a result, there appeared such extreme cases as there being no Chinese technicians in the field of heat control because of the lack of Japanese technicians in that field.

e. Examples are given below on the transfer of technical cadres.

(1) In 1952, on the orders of higher authorities, an election was held for candidates for the positions of section chief and assistant section chief of the production techniques section. After the duly elected candidates were examined, three were approved as section chiefs and assistant section chiefs. During the period from late 1952 through early 1953, all of the three were officially appointed and transferred to other works as section chief or assistant section chief of production techniques section.

(2) In late 1951, when virtually all the Japanese engineers had been concentrated in the basic construction department and began to take charge of designing, a large number (several times the number of Japanese) of Chinese apprentice technical workers (all university graduates) was hired. They then studied designing techniques from the Japanese. A year or two later, these Chinese were transferred one after another to other places.

Note: It seems that the personnel affairs of the basic construction department are directly controlled by the central authorities. In late 1952, when the first-phase construction at this works was generally completed, a large number of technicians and workers concerned was sent or transferred to sites of basic construction projects of other works. This fact has been described earlier..

(3) Since 1951 after this works began to curb the use of iron ore produced within SHANSI Province, the transfer of cadres and workers connected with mines to places outside the province gradually increased. Especially with the formulation of the 1953 plan, under which the use of iron ore produced within the province was to be curbed to near suspension, most of the mining technicians were transferred out of the province in late 1952. Their destinations were LUNG-YEN, AN-SHAN, and remote places in YUNNAN and SINKIANG provinces. These transfers were carried out on the orders of the central authorities. Those selected for transfer were actually in a situation where they could not refuse the assignment because of the spirit of the "service to the people". Consequently, the technical leaders chosen to go to SINKIANG at the time were panic-stricken.

8. Demotion and relegation of key personnel

This will not be re-explained here, since examples have already been given concerning the demotion and relegation of key personnel to other works. (see I, 7 "anti-revolutionary Suppression Movement and the Three-anti and Five-anti Movement"). In 1950, LIANG Hai-chiao (STC 2733/3189/4255), director of this works during Chinese Nationalist control, was relegated to the position of director of the Hsuan-hua Ironworks.

9. Training of workers

a. There is virtually no worker with past experience among newly hired workers. Therefore, they are hired as apprentice workers and are trained as quickly as possible.

b. With the consummation of the specialization system and the operational regulations in the workshops, the workers' training period has been radically reduced. However, workers who receive this type of training can only do certain standard work. Consequently, when their assignments are changed, they again become unskilled workers no better than the apprentice workers.

c. In the case of new operations, experienced workers are either sent or transferred from other works and these men form the nucleus for training the workers in the new operational departments.

d. In the case of this works' sheet mill, however, a considerable time was required to train the workers and to normalize operations because there was practically no one in CHINA who had formal experience in sheet rolling. On this occasion, 60 workers were selected from the medium bar mill and were given about four months' training by Japanese engineers. They were then sent to Sheet Mill No 1 in AN-SHAN for six months' practical training. In addition, when test operation started, two men skilled in sheet rolling were sent from AN-SHAN for actual supervision. (For details, see the paragraph on sheet rolling.)

10. Promotion of workers to technicians

After the Chinese Communists took control, they selected the skilled workers from among the shop workers who had worked continuously from the Japanese era and promoted them to the position of technical workers.

11. Efficiency report

a. Efficiency reports contain the ideologies and work accomplishments of the employees. However, it seems that these reports are prepared only on key personnel and not on ordinary workers. They were prepared on the Japanese technicians.

b. These reports are used as reference in examining and determining ideology, capabilities, and work accomplishments on such occasions as the granting of pay raises or promotions, or in effecting transfers.

c. Efficiency reports were prepared once each month in the following manner:

(1) At political classes, the person in question writes down on the report a comprehensive self-criticism on his own work and ideology.

(2) The leader of the study group and the recorder ask the opinions of the group members concerning this self-criticism. They then consolidate all opinions and enter salient points on the efficiency report. After the entries are completed, the leader reads them aloud and asks once more for objections or additional opinions. After these have been carefully recorded, the efficiency report is presented to the chief of the administrative control section.

(3) The chief of the administration control section enters his views at the end. The person in question then enters his final impressions. After that, the approval of the person in charge of administration (chief of the administration department ? /TN Sic./) is received.

(4) The person in question hand carries the report thus drawn up to the personnel office.

(5) The personnel office files the reports and pulls them out for reference when the person in question is up for pay raise, promotion, or transfer.

(6) In the case of a transfer, the personnel office seals and hands the report to the person concerned. He in turn carries it with him to the place where he is transferred and there he must submit the report.

K. Wages and Allowances

1. General

a. The information contained in this paragraph is that for the period up to the end of the first quarter of 1953.

b. The wage and allowance system in effect at this works at the end of the first quarter of 1953 is reported to have been set up in mid-1950.

c. Wages and allowances are made up of basic wages and production incentive pay (additional pay).

d. The basic wages at this works are said to have been improved considerably with the rise in production efficiency. It is reported that the actual amount of the basic wages paid generally reached the standard in mid-1950 where it would maintain the lowest livelihood of the workers.

e. The production inducement pay is said to be a type of efficiency pay which is paid only to shop workers when their production surpasses the norm without exceeding the planned cost.

2. Basic wages

a. Method of determining the basic wages

(1) The basic wages are determined by a democratic conference of all persons in each workshop.

(2) This method of determining basic wages is called the P'ING-HSIN-CHIH (STC 6097/5647/0455). The Chinese character HSIN (薪) means wages, therefore P'ING-HSIN (評薪) means "wage appraisal".

(3) Wages are appraised on the basis of the table of grade standard which is set forth under the position classification system. However, it is reported that the grade standard had not been unified throughout the nation at the end of the first quarter of 1953.

(4) Wages are appraised every time wage bases are revised. As far as the staff personnel is concerned, this P'ING-HSIN-CHIH exists in name only. In fact, "wage appraisal" of the staff personnel is reported to have been held only once up to the end of the first quarter of 1953.

b. Procedure for wage appraisal system

(1) The first "wage appraisal" was held in May or June of 1950.

(2) The procedure is as follows:

(a) First of all, the "wage appraisal committeemen" write down on blackboards in each workshop the presupposed figures for the basic wages (grade and actual amount) of all the workers of that workshop.

(b) With these presupposed figures as the standard, all the workers deliberate whether these figures are adequate, and then make decision so as to keep the wages within the wage budget shown separately.

(c) The results are submitted to higher echelon through channels and the director of the works makes the final decision.

Note: Details on just what happens during this period are unknown, but it is believed that the framework of the total basic wages of each workshop is determined in the wage budget, and the actual amount and the grade of the wages of each worker is determined within this framework.

(3) Wages of staff personnel with the rank of engineer and above is determined as one unit. The results are presented to the central government for final decision.

(4) Usually one person from each workshop is selected to serve on the wage appraisal committee. This selection is held in utmost secrecy. The Party committee of the works selects a person, and with his consent it appoints him.

(5) The factors given consideration in wage appraisal are educational background, work history, everyday attitude toward work and mode of life. Appraisal of wages based on the educational background is made according to the standard which had been legally established for that purpose. The most emphasized is the daily attitude toward work.

Note: This method of determining wages described on the preceeding page was called YANG-PAN (STC 2876/2647) in the workshops. YANG-PAN signifies board on which model or pattern is shown. This terminology seems to have been adopted because the wage appraisal committee publishes on blackboards the presupposed amount of wages (pattern which gives the basis) for determining the wages.

c. Pay grades

(1) Since autumn 1949, the total pay grades of this iron and steel works was made up of 32 pay grades.

(2) Wages for shop workers were divided into eight grades from 1 to 8. Those for office workers in the technical field were divided into over 10 grades. Details on pay grades for office workers in the administrative field were unknown.

Note: Originally the pay grades for workers in the administrative field were generally lower than those for workers in the technical field. The base pay of the director of the works was far less than that of the high ranking technicians. However, with the revision of the position classification system at the end of 1952, the wage standing of a director-grade one became the highest in the works. The wage standings of the administrative workers are believed to have been raised proportionately but details are unknown.

(3) Of the pay grades in effect at this works at the end of the first quarter of 1953, those known are given in Table No 10-96.

d. Unit for computing wages

(1) After the Chinese Communists took control, the TZ'U (STC 7400) was the unit first adopted for computing wages.

Note: The TZ'U is a unit for computing wages and is equivalent to a set amount of the various daily necessities sufficient for providing a minimum livelihood for one adult for one day. It is a type of unit of calculation on stabilized prices that was adopted during a period of inflation. The wage of one TZ'U is a standard by which one person can live one day.

(2) Since mid-1952, the fen became the unit for computing wages at this works. The fen represents the sum total of the set amounts of each of 15 commodities necessary to maintain livelihood.

Note: The fen also is a unit of calculation on stabilized prices that was adopted during a period of inflation, but there is some doubt that it involved 15 commodities.

(3) On the fifteenth of every month, the local People's Government announced the monetary conversion value of the TZ'U and the fen (how many yuan the TZ'U or fen was worth in People's notes). Wages and allowances were calculated in terms of yuan according to the figures announced.

e. Form of wage payment

(1) From the time the Chinese Communists confiscated the works in April 1949 until September of the same year, wages and allowances were mostly paid in kind. The pay was in millet. However, a small amount of pocket-money was paid in cash.

(2) From about the time that the Central Government was set up in October 1949, all wages and allowances came to be paid in cash. The system of paying in cash was still being used at the end of the first quarter of 1953.

f. Wage base

(1) During the period immediately following the Chinese Communist confiscation of the works in April 1949, the actual amount of income that was in effect during the Chinese Nationalist era was adopted as the wage base. This remained the same until September of the same year. Therefore, the ordinary worker had difficulty making a living. As mentioned earlier, wages were calculated in terms of commodities and paid in kind but with only one computation a month, it was impossible to keep abreast with the tempo of the catastrophic inflation of the time. Moreover, the wage base of the Chinese Nationalist era was hardly enough to provide a minimum livelihood. It is reported that the actual wages at that time were only one-third of what they were at the end of the first quarter of 1953.

(2) These conditions were improved somewhat after the Central Government was set up in October 1949. At that time, the wage base was raised and payment of all wages in cash came into effect. However, since the period was one of inflation, ordinary workers had to live in debt.

The inflation was generally brought under control in the first half of 1950 and wage bases were greatly raised in an epochal wage adjustment carried out in mid-1950. Consequently, workers in general could now make both ends meet. Subsequently, as the production efficiency speedily rose through the adoption of various measures, the actual wages also rose gradually.

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(3) The wage base of the works from late 1952 through early 1953 averaged 220 to 230 fen. The basic wage of the director was 1,200 fen; that of a first class engineer, about 1,150 fen; and that of a second class engineer, about 1,000 fen. The basic wage of the lowest grade worker (apprentice worker) was 60 fen.

g. Method of wage payment

(1) Work amount is computed twice a month -- once on the fifteenth and again at the end of the month -- and the wages are paid two or three days later.

(2) The first pay is a rough estimate pay, while the second pay is a settlement pay.

(3) The work amount is computed by the payroll clerk of each section and is submitted to the accounting office. The payroll clerk receives from the cashier's section of the accounting office the wages for workers of his section in a lump sum and pays each worker by enclosing the cash, together with a statement of account, in an envelope.

3. Production incentive pay

a. Term of payment

(1) The production incentive pay is computed and paid every month.

(2) The production incentive pay is computed by and paid to each plant or department.

(3) The production incentive pay is paid on conditions that the production plans were surpassed and the planned costs were reduced. In other words, when the actual output at a plant in a certain month exceeds the planned output and when actual costs are lower than the planned costs, a certain percentage of the difference between the actual costs and the planned costs is paid to that particular plant as production incentive money. Consequently, even though the production plan is surpassed, no production incentive money is paid if there is no accompanying reduction in the planned costs.

b. Authority on payment

The director of the works is the final authority on the payment of production incentive money. Actually, however, the assistant director for production makes the decision.

c. Payees

The production incentive money is paid to the workers and office workers of the various plants and departments directly engaged in production; no payment is made to workers of non-productive departments. The production incentive pay, computed and paid on plant or department basis, is distributed among workers and office workers of the plant or department.

d. Time of payment

The production incentive money is paid every month, but since it is computed on the basis of production results, the pay is made a month late.

e. Computing method

The computing method is as given in the following.
(Planned costs - actual costs)/ton x actual output (ton) x 0.29

Note: The 29 per cent is the maximum percentage legally allowed. Consequently, there actually are cases where the percentage is less than 29 per cent. When the percentage is 29 per cent, the remaining 71 per cent is diverted to the director's fund and payment to the national treasury.

The "workshop" and transportation departments are auxiliary, service departments of production. Therefore, the computing method for these departments is rather complicated.

The production technique section under the supervision of the assistant director for production is in charge of computation. Therefore, the cost accounting is not nearly as close and accurate as when it is done by the cost accounting section of the accounting office. The cost factors are limited to three items; namely, the direct expenditure for raw materials, direct expenditure for personnel and the indirect plant expenditures. Consequently, such expenditures as the part of the general management expenditures of the works allocated to be borne, depreciation, and expenditures for improving facilities are not included. It should be called the estimated plant costs.

f. Rate of distribution

The rate of distribution of the paid production incentive money to each person is set up by each plant or department. The office workers are generally given less than the shop workers. The rate also varies among workshops of a plant. That is to say, the important workshops get a higher percentage of distribution.

g. Actual amount paid

Concrete figures are not known, but in the highest month in 1952 the amount each worker received was about half his base pay.

h. Parade by plant or department

The plant or department that wins production incentive money holds a celebration and parade through the works carrying placards and banners on which are written in bold letters its achievement that won the prize.

i. Gratitude expressed to the production technique section

The production technique section contributes a great deal to the various plants and departments in helping them win the production incentive money. Not only is this section in charge of the computation for payment of incentive money but it also constantly extends technical guidance to improve production achievements of the various workshops. However, since the production technique section is a non-productive section, it receives no production incentive pay. Therefore, the plants and departments that win production incentive money express their gratitude to the section by sending letters of thanks or by presenting the section a flag of gratitude.

4. Travel allowance

The instance related below is that of an engineer who made an official trip during the first quarter of 1952.

a. Purpose: to supervise the collecting of parts for the sheet mill

b. Destination: SHANGHAI

c. Status: first class engineer

d. Daily allowance: five fen

e. Transportation expense

An amount equivalent to the actual expense was paid in advance. Soft seat (second class) was authorized in travel by rail

f. Board and lodging

This was borne by the Shanghai Engineering Office of the Iron and Steel Industry Control Bureau. He lodged at the Shanghai Reception Center (the former New Asia Hotel)

g. Time: January to March 1952

Note: 1. Ordinarily, engineers ride on hard-seat cars (third-class cars), but it seems that since this particular engineer was old and since he received guest treatment, he was authorized a soft-seat car.

2. Arrangement for the trip was made by the authorities of this works by filing an application with the T'ai-yuan Municipal Public Security Office. Upon arriving in SHANGHAI, the engineer reported to the Shanghai Municipal Public Security Bureau and underwent the prescribed formalities. The official trip took a month longer than expected, but the Shanghai engineering Office took care of the official procedures on behalf of the engineer.

5. Treatment of Soviet technicians

The salaries of the Soviet technicians that were employed are set forth under an agreement between the Chinese Communist government and the Soviet government. The amount is said to be 30 times the basic pay of the ordinary shop worker.

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I. Welfare Facilities

1. The director's fund

The meaning, character, sources and usage of the director's fund will not be repeated here, since they have already been covered (see E, 1, b Note 1). Given below are some concrete facts about the director's fund for 1952.

a. The director's fund for 1952 was 29 per cent of the total profit in 1951. In actual figures it was three billion and several hundred million yuan.

b. Time of appropriation

The time of appropriation was April or May 1952. Since the enterprise profits are determined after the fiscal accounts are settled, a rough estimate should have been known by about February of the following year. However, it was April or May before the director's fund was officially determined through the approval of the central authorities. The director's fund for 1952 at this works was announced in April or May 1952.

c. Usage

In 1952 it was used to help build housing and recreation grounds, and as prize money for the labor heroes of this works.

Note: Since large-scale company housing construction is an object of basic construction investments, the use of the director's fund was limited to the construction of auxiliary welfare facilities in and around the company housing area.

2. Company housing facilities

a. Construction of large company housing areas

(1) In the Japanese era there were only 10 company residences for the use of the office workers. The ordinary plant workers lived in a group of shanties in SHIH-LI-P'U on the north side of the plant. This group consisted of 50 shanties for families and two dormitories for bachelors.

(2) After the Chinese Communists took control, the construction of a large company housing area was planned on the north side of Hsin-che'ng Station. Work was started in 1951, and at the end of 1952, one thousand units were completed. The project was still in progress at the end of the first quarter of 1953.

(3) Attached to this company housing area were an administration office, a consumer's cooperative, a worker's hospital, school, and nursery. Early in 1953, a workers' grounds, a workers' club, a flower garden, and a store were constructed on the east side of the plant. The workers' club was called the cultural hall, and it accommodated 700 to 800 people. The

store, a modern two-story brick structure, was built next to the cultural hall by the provincial government.

(4) Most of the money for these constructions was supplied from the state basic construction capital.

Note: It has already been related how the construction of high class houses (Hua-yuan residences) for the staff personnel of this works met the criticism of the workers and was halted. In this criticism, the workers said it was imprudent to spend a lot of state money to build luxurious homes for a few important persons while the homes of the shop workers were not adequately equipped. For this very same reason, the construction of the works' main office was put off. Details on this office will not be repeated here, since they have already been related in the paragraph on basic construction.

b. The conditions of workers' housing (end of the first quarter of 1953)

(1) Housing in KU-CH'ENG-TS'UN

These were the houses for the Japanese workers (with their families) during the Japanese era. They are located in KU-CH'ENG-TS'UN on the western edge of this works. They consisted of 10 two-family units. At present, about 20 families are living in this housing area -- see Chart No 10-69.

(2) Old barracks housing

Before the end of the war, these quarters housed an airfield guard unit (about one company). They are now utilized as family homes for the shop workers. The Chinese call the housing area TA-KUNG-P'AN (STC 1129/1362/4149). There are 20 to 30 buildings. They have dirt walls and tile roofs and each building accommodates six or seven families.

Note: There is a branch cooperative at the edge of this group of houses.

(3) The housing area in SHIH-LI-P'U

These houses were built during the Japanese era. They consist of two bachelors' dormitories and five 10-family units for the shop workers and their families. They are crude shanties -- see Chart No 10-70.

(4) Newly constructed housing project

New housing project were constructed after the Chinese Communists took control. There are ten housing units arranged parallel to each other in each row. Each unit (one-story building four meters by 40 meters) accommodates 10 families. In all, there are about 80 family units. The rows are spaced at 15-meter intervals and there are streets lined with green belts on both sides.

3. Health and sanitation

a. Hospital

In May 1952 the Tai-yuan Iron and Steel Works Hospital consisting of two-story brick buildings was constructed in May 1952. It is a general hospital and has various departments and several ward buildings.

b. Preventive sanitation facilities

In plants where operations involve high temperature and poisonous gases, various types of preventive sanitation measures are in effect. In the rolling mill, for example, since hot billets are handled there, cool air is introduced from the roof and blown in to the workers. The rolling mill is equipped with several fans.

c. Providing nutritious foods

Workers engaged in operations injurious to health are provided with nutritious foods. These workers receive about eight eggs every day.

Workers in plants where the temperature becomes very high in summer are provided with an almost unlimited amount of watermelons and cider. For this reason, this works has a cider plant of its own.

4. Old age pensions

Under the provisions of the labor insurance regulations, workers over 60 years of age are paid a certain amount of old age pension every month, in addition to their regular wages. Even the Japanese detainees before they left for JAPAN received a settlement pay for the number of years they worked. Given below is the case of one repatriate who received five years' pension in a lump sum.

a. Amount paid: 42,000,000 yuan (about 600,000 yen)

b. Paying organ: The T'ai-yuan Iron and Steel Works

c. Age of the worker: 70 years old at the time of repatriation (April 1953)

d. Length of period detained: about eight years (about four years during Chinese Nationalist control after the war's end and about four years during Chinese Communist control); the number of years that the worker was employed at this or other plants before the war's end is believed to be included in the term of service required for payment of old age pension that is provided under the labor insurance regulations.

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M. Technique and Technical Training

1. Outline

Only information generally up to the end of the first quarter of 1953 can be clarified in this paragraph. The technical standard of the Chinese at this works is still generally low. It is no exaggeration to say that the Chinese workers as a whole are in the stage of technical training. The characteristic of this technical training, however, is that it is strictly based on actual operation. The emphasis is placed on strict adherence to a system whereby technique is learned through actual operation and the technique so learned is immediately put to practice to raise operational results.

Consequently, all the measures adopted may be said to point to that end. The operational setup in itself is formulated to coincide with this aim. The tempo of learning and mastery of technique in a specific operation is speeded up by the adoption of a high level specialization system under which the same operation is repeated. Moreover, operational regulations were drawn up to make this system even more effective. By strict enforcement of these regulations, all operations are minutely divided and extremely standardized and simplified.

As it can be seen in the "teacher-student contract" which will be explained later, the system whereby workers with a low technical level are trained into skilled workers in the shortest time possible by teaming such workers with those with a higher technical level in the workshops and the training system directly connected with operations, may also be regarded as manifestations of the aim. At any rate, since "operation is training" and "training is operation", training is virtually inseparable from and is directly connected with operation. A stipulated production plan is executed even in the process of training. In fact, it would be much closer to the truth to say that the inseparable relationship between training and operation is formed whereby workers in the course of actual operation individually devise and study the means and mutually teach and train each other to accomplish or surpass the production plan. The previously mentioned work review meeting, making public of technical skills, idea suggestion, and mass discussion for formulation of plans are all based on this aim. Thus, in this sense, this works as a whole is in the stage of technical training. Nevertheless, it must also be recognized as a fact that this works is making great strides in promoting production efficiency even in this stage.

After the Chinese Communists took control, detained Japanese technicians were depended upon for the technique and technical supervision at this works until about the end of 1952. During this period the gradual induction of Soviet technicians was planned. When the Japanese technicians were repatriated in 1953, Soviet technicians were brought in on a full scale. It seems that thereafter the direct supervision by Soviet technicians has gradually gained hold. Information available on these matters, excluding those previously covered, is outlined below.

2. Detainment of Japanese technicians

At the end of 1952, there were approximately 40 engineer-class technicians including more than 10 Japanese technicians. These Japanese technicians had the highest standing, qualitatively speaking, in all the technical supervisory fields at the works. On the whole, the Chinese technicians had little practical experience. Even the university graduates (mostly technical-worker class), who are believed to have been trained with emphasis on practical training after the Chinese Communists

took control, needed the supervision of Japanese technicians in the field of application of operational techniques. Generally speaking, the detainment of the Japanese technicians was a decisive factor in the restoration of facilities, resumption and normalization of operations, restoration and development of production, and training of technicians and skilled workers at this works. It is no exaggeration to say that the T'ai-yuan Iron and Steel Works would not be developed to where it is today if it had not been for the detained Japanese technicians. In spite of this fact, the accomplishments in the technical fields which were actually planned or supervised by the Japanese technicians were often publicized by accrediting them to the "supervision of Soviet technicians."

3. Introduction of Soviet techniques

Soviet techniques were introduced by publishing translations of Soviet technical books, tour of supervision by Soviet technicians, and by sending workers to schools in the USSR.

a. Publication of translations from Soviet technical books

Soviet technical books were introduced into the works in 1951. Most of them were of the textbook type, but some dealt with very specialized fields such as plant planning. Many of these technical books have been translated, and a large number of these translated books have come to be sold from 1953. There were many errors in translation, but on the whole, they offered no impediment for actual usage.

Such textbooks as the "Rapid Steel Manufacturing Method", and the "Speedy Furnace Repair Method" were widely in use. These textbooks give a detailed account of equipment designing, operational method and actual results of operations, and they are written clearly and exhaustively. Therefore from the practical standpoint, these textbooks have contributed much to the acquisition and popularization of technique.

A document dealing with the planning of plants contained the plans for various plants. Photographs of an open-hearth furnace plant (ferroconcrete walls and the use of iron frames for beams and pillars) were novel. Technically speaking, these documents and references were not of a high standard and none had any particular appeal. Details will not be repeated here because most of them have already been covered in the various paragraphs dealing with the operations and facilities of the various departments of this works.

b. Tours of guidance by Soviet technicians

Until the end of the first quarter of 1953, there were no Soviet technicians exclusively attached to this works. Consequently, guidance by Soviet technicians was always dependent on tours of inspection sent to the works by the Central Government. These Soviet technicians were permanently based at the Iron and Steel Industry Control Bureau of the Ministry of Heavy Industry.

Inspection tours were conducted about once every two months. However, since different technicians specializing in different fields came each time, the number of tours made for one specific department was only one or two a year. The exception is when great problems arose: a specialist in the field concerned was dispatched by an airplane each time on such occasions.

There were two or three supervisors in each tour. They stayed about one week at the works on each tour. In spring 1953, the following nine Soviet supervisors reportedly were to come to the works on a tour:

(1) Administrative department: two supervisors

(2) Pig-iron manufacturing department: one supervisor

(3) Coke department: one supervisor

(4) Steel manufacturing department: two supervisors

(5) Electric furnace department: one supervisor

(6) Rolling department: one supervisor

(7) Test and inspection department: one supervisor

The various specialized fields of the Soviet technicians were broken down to a very minute degree so that the technicians knew very little of matters outside their own specialized fields. It seems that they were fairly competent in their own special fields. Most of the technicians were young. Whenever a question was asked, all the technicians would do was to show a textbook, and they would not normally go into a detailed explanation. It was thought that these technicians who were sent out were only second-rate technicians even in the USSR. However, the presence of technicians who specialized in the fields of planning and administrative control, such as a planning expert or a cost accounting expert was an unusual phenomenon.'

c. Adoption of the Soviet systems and operational techniques

For information on this matter, see various paragraphs under the departments concerned in this chapter, since this information has already been explained in those paragraphs. Example are the methods of close selection, mixing, and charging of raw materials; method of furnace repair; steel manufacturing schedule; insertion of pipes during steel manufacture; blowing in of compressed air; specialization of operations; responsibility system; statistics and accounting systems; and the operational regulations.

The members of various workshops and work teams are instructed to carefully keep in mind what the Soviet technicians have taught and to observe them as golden rules. They are warned that any person who does not abide by these teachings would be punished as an ideological retrogressive element or as a deviating element.

Note: In spring 1953, a load test of a ladle crane at the open-hearth plant was run in the presence of Soviet technicians. The fact that the planned steel output for the same year was cut down from 130,000 tons to 114,280 tons as a result of this test sufficiently convinced the shop workers of the authority of the Soviet technicians.

d. Workers sent to USSR to study

After 1951, several leading office workers connected with administrative fields of statistics and planning were sent to the USSR for study each year. Those who were eligible for study abroad were the party leaders who had participated in the revolution and those who have attained the scholastic standard equivalent to that of university graduates. The students were classified into the seven-year group and the two-year to three-year group. The students in the seven-year group reportedly study mostly language for the first three years and receive specialized education during the remaining four years. Up until the early part of 1953, very few office workers in technical line had gone to the USSR for study. In 1951, one female office worker from the technical supervision section, and in 1952, two male office workers from the same section were sent to the USSR for study. These were all technicians in the field of analysis. The duration of their study was reported to be the same as that mentioned above.

4. Absorbing the techniques of various free nations

Strong interest was shown also toward absorbing of good points of the techniques of advanced Western nations and JAPAN. Some of the works' technicians believed that the Soviet techniques were patterned after those of the Western nations, and thus they were enthusiastic about learning the techniques of the advanced Western nations. Needless to say, reading of reference books and literature being the only way to study, technical books and related literature of JAPAN and Western nations were widely utilized. This trend appeared among technicians in the field of experimentation and research more strongly than among the technicians directly connected with production.

5. Favorable treatment of technical workers

The standing of the technical workers is not necessarily superior to that of the administrative workers. From the standpoint of wages and allowances, the technical workers are better paid than the genuine administrative officials. These conditions are clearly shown on the previously mentioned wage and allowance scale.

Even in the same technical field, the technician who manages production work is generally far better treated than the technicians who are engaged in actual works in the workshop. This is believed natural under the system of socialistic planned production, and those technicians who are in charge of plan control, which may be called either technical management or management technique are highly valued. The Soviet specialists are mainly in charge of technical management. In this sense, the Soviet specialists hold the highest supervisory position in the field of technical management. The training of specialists in this field is now particularly emphasized by the Chinese Communist authorities. The training of management technicians is given high priority over that of ordinary technicians. This point is clearly evident even in the selection of persons sent to the USSR for study. The extent of the importance of this field may be surmised from the fact that the training and supply sources of management technicians are particularly limited to the leading party members.

6. Liaison with schools and training sections

In regard to supply and training of staff workers, the works is maintaining close liaison with various schools concerned and the outside training organs.

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Until the end of the first quarter of 1953, the demand was greatest for staff workers who had completed the regular technical education at universities and technical schools. The supply of these personnel, however, was extremely limited because it had been only two to three years since the Chinese Communists took control.

In an attempt to tide over this situation, the works authorities adopted a method whereby a large number of higher middle school graduates are employed and trained to become middle-class staff workers while engaged in actual work for a certain period of time. The promising ones are then selected from among them, and dispatched and enrolled in universities by the works authorities. They are scholarship students sent by the plant authorities. They study for a certain period of time (mostly short term) while maintaining their status as personnel of the works and return to their posts upon completion of their courses.

Note: Since 1952, the number of students invited by universities has been exceeding the number of higher middle school graduates. In 1953, the number of higher middle school graduates was only about 70 per cent of the number of students invited by universities. In the same year, a good many number of higher middle school graduates were assigned to this works. The scholastic level of these higher middle school graduates assigned to this works while they were in school was generally mediocre, but most of them were ideologically well-advanced.

There was a fairly large number of these young staff workers who wished to take university examinations without the recommendation of the works' authorities. However, most of these persons gave up this ambition after they were dissuaded or criticized by the works authorities, workers' union, or youth organizations. These persons were comprised of those indispensable to work or of those ideologically unfit.

For the purpose of training personnel for the test and inspection department, the office workers who had graduated from schools were trained at the works for about one or two years, and then sent to the training section of the metalurgical research institute in PEKING. The training period was from six months to one year. There was no suitable training organ that will serve the above purpose in the T'ai-yuan area.

7. Teacher-student agreement

a. Significance of the teacher-student agreement

The teacher-student agreement is an agreement between an experienced worker and an inexperienced worker at the workshop to give and receive technical education through harmonious teamwork over a fixed period. The literal meaning of this agreement is a contract between boss and apprentice. This, however, does not mean the revival of the feudalistic apprenticeship, but is a pact concluded between mutually independent fellow workers of equal rank. This point was emphatically stressed. It is said that the basic spirit of the agreement is to respect the teacher and love the pupil.

b. Date of adoption

It was in 1950 that the teacher-student agreement system was adopted at this works, but it is since 1952 that the system has become widely practiced.

c. Teacher-student team

The teacher-student agreement is normally concluded between shop workers, but it was occasionally concluded between an engineer and a technician as well. In the case of an agreement between workers, one inexperienced worker is teamed up with one experienced worker to form a team. Since an agreement between workers whose technical abilities are far apart, adversely affects the working efficiency, the control authorities guided the workers so that a team would be formed between two workers whose positions were no more than two classes apart. Although, each individual was in no way restricted in forming his own team and in drawing up an agreement, actually teams appealing to the authorities were formed because any technically improper team-up was subjected to criticism on various occasions.

d. Term of an agreement

The term of an agreement is generally several months. It seldom exceeded one year. This was because the basic aim of this system was to train inexperienced workers in a very short time.

e. Skill test

In the case of teacher-student agreement between technicians, regularly scheduled skill tests seem to have been conducted to determine the results of such an agreement. However, no special test was conducted in the case of workers because the improvement on their technical skills can be easily determined through their daily work results.

f. Awards

It is prescribed that a team which has reached the goal within the term of agreement be granted an award in the form of a pay raise or promotion. As a result, the teacher-student agreement has been conducted very earnestly.

g. Results

Because of the earnestness on the part of the workers in practicing this system and the enforcement of the high level work division system, this system was showing an immediate effect on the improvement of the workers' skill.

h. Agreement form

A printed form was used in drawing up the agreement. Provided in this form were necessary columns such as those for entering the names of both teacher and student, conditions of the agreement, the term of the agreement, and the date of agreement. Woven into the agreement clauses are such familiar expressions as "the student will respect the teacher and ask for instruction. At the same time, the teacher will...".

i. Example

In this paragraph, the cases where Japanese technicians were teachers are cited. Originally, the detained Japanese were kept from taking part in this system. However, in early 1952 when the outlook for the Japanese repatriation became only a question of time, Japanese technicians were allowed to sign the teacher-student agreement to train their technical successors on orders from higher authorities.

For instance, one Japanese technician trained two or three Chinese technicians in the operation of the reverberatory furnace at a chilled casting plant for about one year. However, the results were by no means excellent. Particularly, the mixing operation at the time of melting was difficult. Therefore, only one of the two or three Chinese technicians who was especially attentive is believed to have barely acquired the technique.

When this Japanese engineer was dispatched to the Shanghai Engineering Office to supervise the collection and designing of sheet rolling equipment between January and March 1952, KAO Hung (STC 7559/4767), the head of the sheet mill of this works, went along and received instructions from the Japanese engineer under the teacher-student agreement. Following their return from the official trip, this instruction was continued through actual operation until the end of April 1953.

8. Study system

a. Types of study

The study may be classified into two major types: practical and political. The practical study is carried out for the purpose of enriching practical knowledge on operational technique and working methods. The political study is conducted to impart and widen the basic knowledge on state policies, history, current events, and sanitation. These two studies are compulsory, and all workers must attend them as long as their attendance does not interfere with the performance of offical duties.

Besides these compulsory studies, there also are off-duty study classes, but attendance is on a voluntary basis. Subjects consist of Russian language, word recognition, and general knowledge and are not always fixed.

b. Date of enforcement of this system

This study system has been in effect at this works continuously since the early days of Chinese Communist control. The political study was conducted mainly at the beginning. The reason for this is based on the opinion that political and ideological trainings are the foundation for all other education. The view that the correct understanding and application of techniques can be attained only when political and ideological knowledges are thoroughly spread and enhanced forms the consistent basis underlying the study system. For this reason, the political study was first started, and with this as the foundation, the practical study was started.

c. Study hour

As already mentioned in the paragraph under the work system, study classes are held two hours each day for 12 hours a week. In early 1953, eight out of these 12 hours were spent in political study and the remaining four hours in practical study. Thus, emphasis was still on political study.

The classes were held outside the working hours for shop workers and during working hours for clerical workers. The classes for the latter were usually held simultaneously throughout the works, especially in the morning.

Note: In the clerical department, all workers suspended their work and participated in studies during working hours. It is reported that the people were not permitted even to receive telephone calls during class hours.

d. Procedure

The study classes were supervised and directed by the party headquarters within the works. A party member was always present during the study hours.

Study sections were formed according to the participants' scholastic and ideological levels, and study class was held by each section which consisted of seven to eight or 12 to 13 members. The system of study was mainly through discussions. Section leaders or teachers were either appointed or chosen from the section by vote. Each member was supplied with a notebook and at times was given printed references. By spring 1953, each member had accumulated references of this type amounting to about 10 centimeters in thickness.

Note: These notebooks were called "study handbooks" and were uniform in size -- 155 millimeters in length and 95 millimeters in width. Moreover, a special handbook was given to the leading cadres and model workers. It was a thick four by six (TN Unit not specified.) size handbook with a photograph of MAO Tse-tung in it.

e. Training material

Newspapers and government instructions were used in political study. About 10 different types of newspapers, including the Iron and Steel Bureau Report, T'ai-yuan Sh'en-pao Workers' Daily, Shanghai Newspaper, and People's Daily were used. The government instructions were sent directly from the Central Party Headquarters and the Iron and Steel Industry Control Bureau. One example is the order concerning the execution of the Three-anti Movement.

Works by MARX, LENIN, MAO Tse-tung, and SUN Wen (STC 1327/2429), and related literatures were used as training materials in the study of history. Various handicraft models and copies were used as training materials in handicraft classes.

f. Result of study

Although it is difficult to pin-point and list certain facts as results of the study, it can be pointed out as a fact that the Chinese factory workers who were said to have been generally illiterate and inefficient are undergoing complete change from what they had been after the study system was put into effect. Particularly, the fact that those who previously had no interest in politics began, though in a standard manner, to show positive interest and a cooperative attitude toward government policies is a major change. At present, all workers down to the lowest rank have acquired technical skills and basic theories connected with their own workshops and are conscious of their responsibilities. They have been so thoroughly trained that they now spontaneously conduct themselves in perfect orderliness. Even though these are not the results of study alone, it must be admitted that studies, particularly the political and ideological studies and training, had much to do directly and indirectly in bringing on these results.

Aforementioned is an actual feeling of a person who had been with the works. On the other hand, adverse effects of the study activities are also reported. Examples which seem to illustrate this fact are as follows:

(1) The atmosphere in workshops is generally gloomy

(2) Friendly attitudes among fellow workers are lacking

(3) Cases of thefts among the factory workers still persist

It is said that in spring 1953 the workers often brought home coal from the workshop and there were frequent cases of thefts of bicycles.

9. Estimate of the technical level

Although an estimate of the technical level of this works up to spring 1953 can be made only by referring to various items such as types, specifications, output, and accepted rate of products which have been described under each department, the departments which had long been in production can be said to have attained a level of technical skill whereby they can efficiently carry out normal operations.

However, normal operations in the electric furnace plant, chilled casting plant, and sheet mill were frequently interrupted because these departments had not been in operation for a sufficient length of time, and were the most inexperienced departments at that time.

For instance, in roll production, small chilled roll was the only item produced regularly at this works at that time. Chilled rolls for medium rolling mill and sheet mill were being manufactured on an experimental basis. Even from the standpoint of quality, it was impossible to attain self-sufficiency in superior roll. Particularly, it was absolutely impossible to attain self-sufficiency in grain roll of a hardness of 55 degrees.

Note: Only the iron and steel works in AN-SHAN, T'AI-YUAN, SHANGHAI (HSIN-HU), and CHUNGKING were manufacturing rolls in CHINA at that time. Communist CHINA had to import the supply of large superior-grade rolls from the USSR and other foreign countries.

Silicon steel plates were also being test manufacutred at this works at that time. The production of silicon steel plates was the central topic at that time, even from the national standpoint, for its purpose was the manufacturing of insulating plates. The T'ai-yuan Iron and Steel Works was the first plant ever to test manufacture this item in Communist CHINA.

The basic construction department lagged somewhat behind the various production departments in technique. This was probably due to the fact that it had a short history, that it required a comparatively high level of technique, and that it had a shortage of competent technicians. However, the department has already mastered the planning and actual work of construction if it be by copying the existing facilities. Therefore, the department may be said to have felt no serious difficulties in undertaking construction work unaided so long as it copied Soviet plans or the blueprints of existing facilities.

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Supplement: Yang-ch'uan Ironworks

A. Name of Enterprise

The Yang-ch'uan Ironworks

B. Form of Enterprise and Affiliation

It is a state-operated enterprise affiliated with the Iron and Steel Industry Control Bureau, Ministry of Heavy Industry, Central Government.

C. Location and Plant Layout

See Chart No 10-71

D. Types of Operations

The ironworks manufactures pig iron, specular iron (low manganese ferroalloy), and cast-iron pipes and produces fireproof materials and high-voltage insulators.

E. Type of Plant

It was engaged in the independent manufacture of pig iron and also in iron casting operations.

F. Various Aspects of Plant Location

From ancient times pig iron has been widely produced by primitive methods in the Yang-ch'uan area and small scale hand mining of iron ore has also been carried out everywhere in this area. Although the ore deposits here are of the Shansi-type pocket ore deposits, they contain rich iron ore reserves. Thus, YANG-CH'UAN is conveniently located for the collection of iron ore. The principal iron ore producing areas are P'O-T'OU and SHOU-YANG -- 10 kilometers and 50 kilometers, respectively, west of YANG-CH'UAN.

Coke is supplied from the Shih-chia-chuang Coking Plant and the T'ai-yuan Iron and Steel Works. Coal for general use is supplied from the Yang-ch'uan Mining Affairs Bureau, while limestone is locally produced in abundance. Not only does this ironworks have direct contact with the raw material producing areas but it is also located comparatively close to the T'ai-yuan and Peking-Tientsin areas that consume its products. Thus, various aspects of the plant location of this works are very favorable. Distance from this works to T'AI-YUAN is about 120 kilometers and that to PEKING and TIENTSIN is about 400 kilometers.

G. History

1. This ironworks is the successor to the Yang-ch'uan Iron Foundry which was founded in 1918 by the Pao-chin Company. Toward the end of that year, equipment were imported from JAPAN and their installation was completed in 1921. In 1922, the Yang-ch'uan foundry began to manufacture pig iron. At the beginning, the principal equipment was one small (25-ton) blast furnace and technicians were invited from JAPAN. While iron ore was supplied from P'ING-TING, coke was supplied from CHING-HSING.

2. In 1927 operation was suspended because the transportation system was disrupted by civil war. After the resumption of operation in August 1929, the Yang-ch'uan foundry carried on operation, though irregularly, until the outbreak of the Japan-China Incident.

3. Ater the outbreak of the Japan-China Incident in 1937, the Yang-ch'uan foundry came under the control of the Japanese Army, and along with the T'ai-yuan Steel Mill (present T'ai-yuan Iron and Steel Works) of the Hsi-pei Enterprise Company, this foundry was incorporated into the Shansi Iron Manufacturing and Mining Company. However, the foundry became an affiliate of the Shansi Industrial Company Limited, when this company was established in October 1942.

4. In August 1943, the construction of small blast furnace (Nittetsu type) No 2 was started. The furnace was completed and fired in October of the same year.

5. After the war, YEN Hsi-shan (STC 7051/6932/1472) took over this foundry, reinstated the former plant superintendent, a certain CHAO (STC 6392), (a graduate of Cambridge University who served as a consultant during Japanese control) and had him take charge of the foundry. Since all the Japanese detainees were transferred to the T'ai-yuan Steel Mill, the entire plant came under Chinese control. Later, when a Nittetsu type small blast furnace (blast furnace No 3) was transferred from Peking-Tientsin area, the total pig-iron manufacturing facilities of this foundry became three small blast furnaces.

6. This foundry was taken over by the Chinese Communist Army comparatively early - in 1947. At that time, the Fifth Ta-tui (STC 1129/7130) of the 10th Tsung-tui (STC 4920/7130) (Japanese unit) was stationed at this plant as its principal security force. However, after being subjected to a fierce Chinese Communist attack, the unit was forced to surrender the foundry.

7. After the establishment of the Central People's Government in October 1949, the foundry was placed under the direct control of the Iron and Steel Industry Control Bureau, Ministry of Heavy Industry. Ever since then, this foundry has existed as the state-operated "Yang-ch'uan Ironworks." Since this ironworks was restored to operation comparatively early after the Chinese Communists took control, its pig-iron production had soared to more than twice its rated capacity by summer 1950. Therefore, this ironworks was highly praised as a model small blast furnace plant.

H. Principal Equipment

See Chart No 10-72, and Table No 10-97

I. Labor Force

1. Before the wars end: about 600 workers

2. Summer 1950: about 1,000 workers

J. Raw Material and Motive Power

1. Iron ore

Having no mining district of its own, Yang-ch'uan Ironworks was buying necessary iron ore from the local inhabitants who mined ore from test boring shafts. The P'o-t'ou iron ore (iron content, 40 to 47 per cent) comprised the bulk of iron ore consumed by this ironworks.

For the production of low manganese ferroalloy (spiegeleisen -- manganese content, about 20 per cent), the Shou-yang iron ore (iron content, 40 to 47 per cent, manganese content, 7 to 10 per cent) was partly used.

The planned iron-ore requirement for 1953 was estimated to have reached almost 200,000 tons when calculated on the basis of the ore ratio of 2.3. It is believed that Lung-yen and Wu-an iron ore (iron content, over 55 per cent) were also partly used for mass production and for the sake of exchanging raw materials.

2. Coke

After the Chinese Communists took control, coke was chiefly supplied from the Shih-chia-chuang Coking Plant, but in autumn 1952, the T'ai-yuan Iron and Steel Works also began to supply some coke. It is reported that the volume of purchase made in 1953 was about 60,000 tons of Shih-chia-chuang coke and about 30,000 tons of T'ai-yuan coke.

3. Limestone

Locally produced limestone is being used. The amount required in 1953 was estimated to have been about 50,000 tons.

4. Electric power

Electricity was chiefly supplied from the Yang-ch'uan Thermal Power Plant (under the jurisdiction of the T'ai-yuan Electric Industry Control Bureau) and it was partly supplemented by the ironworks' own power plant.

Note: Power output of the Yang-ch'uan Power Plant in early 1953 was 4,000 kilowatts. (During Japanese control there was one 2,500-kilowatt generator. In 1951, one 1,500-kilowatt generator was additionally installed.)

K. Production

1. Pig iron

a. Annual output -- see Table No 10-98.

The peak year before the end of the war was 1944 with an annual output of 14,000 tons. Production in summer 1950 reached about 130 tons a day, and the annual output for that year surpassed the 45,000-ton mark. The planned output for 1953 was estimated to have been about 85,000 tons, assuming that the effective utilization coefficient was 0.8 (cubic meter per ton a day).

b. Products

Foundry pig iron is chiefly produced, but some spiegeleisen (manganese content, about 20 per cent) have also been produced since the latter half of 1950.

c. Destination of products

While a part of the products was supplied to the pipe casting shop of this ironworks, the bulk of the products was shipped to T'AI-YUAN and SHANGHAI.

d. Percentage of products meeting specifications: latter half of 1952 -- 99 per cent

e. Effective utilization coefficient

The coefficient attained in the best month in the latter half of 1952 was 0.8 (cubic meters per ton a day), and it was by no means inferior to that of an ordinary blast furnace. The Yang-ch'uan Ironworks was praised in the Iron and Steel Industry Control Bureau bulletin as a model small blast furnace plant.

2. Cast-iron pipes and other products

The volume of production is not known. Judging from the capacity of the cupola, and assuming that its turnover is two heats a day, the maximum output would be about 3,000 tons. Sizes of cast-iron pipes range from three to 12 inches in diameter.

Note: According to newspaper advertisements, this ironworks also seem to produce high voltage insulators. This item was produced even before the war's end and there generally had been no changes in production until summer 1950.

L. Technique

Since this ironworks had long been in operation from the prewar days, it was operated independently by only Chinese even during Chinese Nationalist control after the war's end. However, in the trial production of low manganese ferroalloy, the guidance of Japanese technicians was needed. Hence, for three months in mid-1950, TAKAHASHI, the former director of the T'ai-yuan Steel Mill, and KATSUHARA, a former assistant director of the Yang-ch'uan Iron Foundry, were invited to teach production methods. The Chinese Communist authorities highly valued the success of this trial production and promoted the director of the Yang-ch'uan Ironworks to the director of the Tientsin Steel Works.

M. Small Blast Furnace

The Iron and Steel Industry Control Bureau bulletin in praising the small blast furnace states that in the case where iron-ore mining is on a small scale and purchased iron ore must be depended upon, the small blast furnace is the most suitable equipment for pig-iron production, since it is small and calls for simple accessories.

The phrase "iron ore mining is on a small scale" means pocket-type ore beds which are not as suitable for mechanized mining operation as the ore beds in SHANSI Province.

It is hardly imaginable that the iron manufacturing facilities in SINKIANG and YUNNAN would be made into large scale facilities, since these provinces are greatly restricted in the field of mining. Therefore, small blast furnaces of this type may possibly have been transferred there.

In 1952 there was a plan to transfer one of the small blast furnaces of the Yang-ch'uan Ironworks to CH'ANG-CHIH (36°05'N 113°14'E) (former LU-AN; 200 kilometers south of T'AI-YUAN). However, since the railway was not yet restored at the time, this plan could not be realized immediately.

This trend of dispersing small blast furnaces runs counter to the plan which was envisioned before the war's end when small blast furnaces were constructed (a plan to attain production equivalent to that of an ordinary blast furnace with one set of 10 small blast furnaces). Ater the Chinese Communists took control, however, the production efficiency of small blast furnaces rose sharply, necessitating a drastic increase in the quantity of iron ore that had to be purchased. However, it seems that because of limitations in the supply of raw material, the dispersion of small blast furnaces presented itself as a new issue and that this issue has come to be tied in with the construction plan for decentralized new iron and steel centers.

Doc No 90225 (10) (PB)

Chart No 10-1

General Sketch of the Vicinity of the T'ai-yuan Iron and Steel Works
(End of the first quarter of 1953)

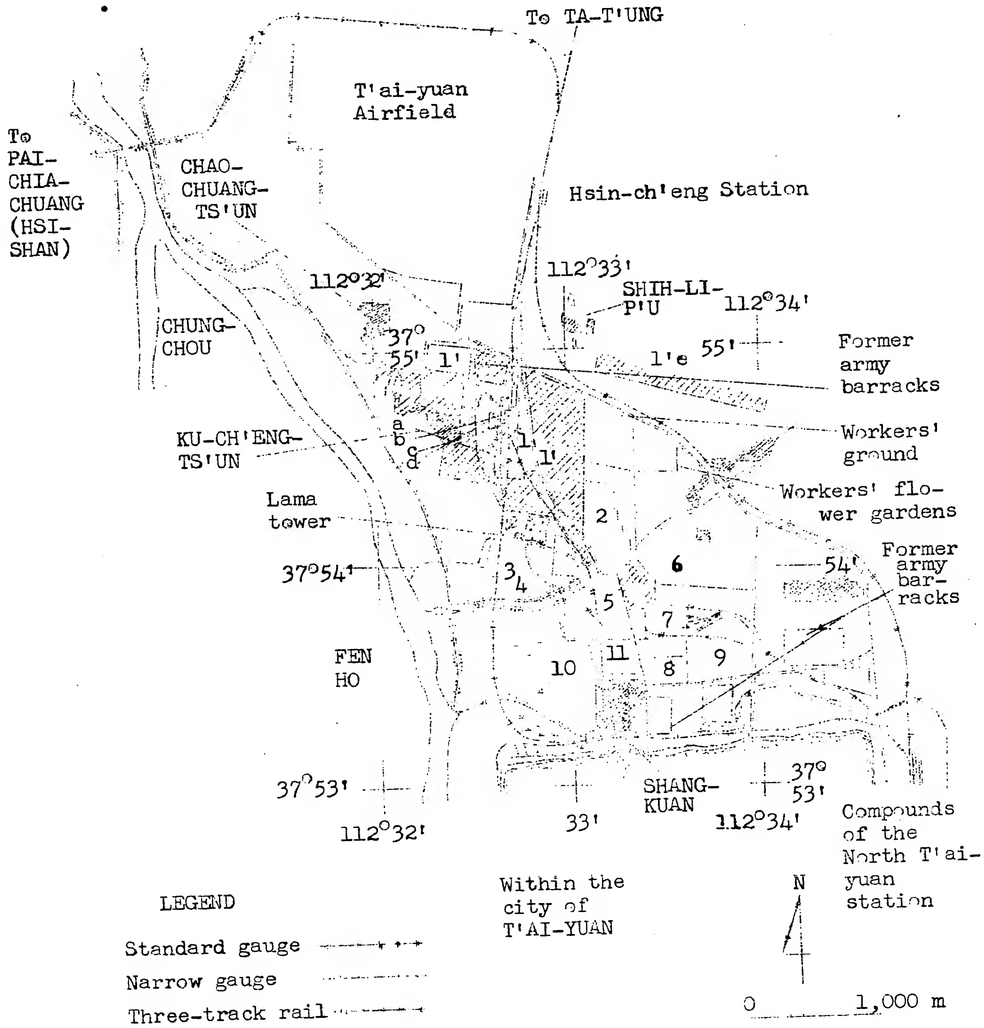

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Chart No 10-1 (Cont'd)

KEY

No	Name
1	T'ai-yuan Iron and Steel Works
1'	Expansion site of the Works (Expanded after Communist control)
1a.	Blast furnace plant
1b.	Coke plant
1c.	Steel manufacturing plant
1d.	Medium and small bar mill
1'e	Workers living quarters (Constructed after Communist control)
2	T'ai-yuan Powder Plant
3	T'ai-yuan Oxygen Plant
4	T'ai-yuan Electrochemical Plant
5	T'ai-yuan Machinery and Tool Plant
6	T'ai-yuan Iron and Steel Works Kiln Yard
7	T'ai-yuan Railway Plant
8	Power plant outside the city
9	T'ai-yuan Arsenal
10	Former T'ai-yuan Printing Plant (Bombed and burned to ground)
11	Former T'ai-yuan Chemical Plant (Same as above)

Doc No 90225 (10) (?)

Chart No 10-3

Operational System of the T'ai-yuan Iron and Steel Works
(End of the first quarter of 1953)

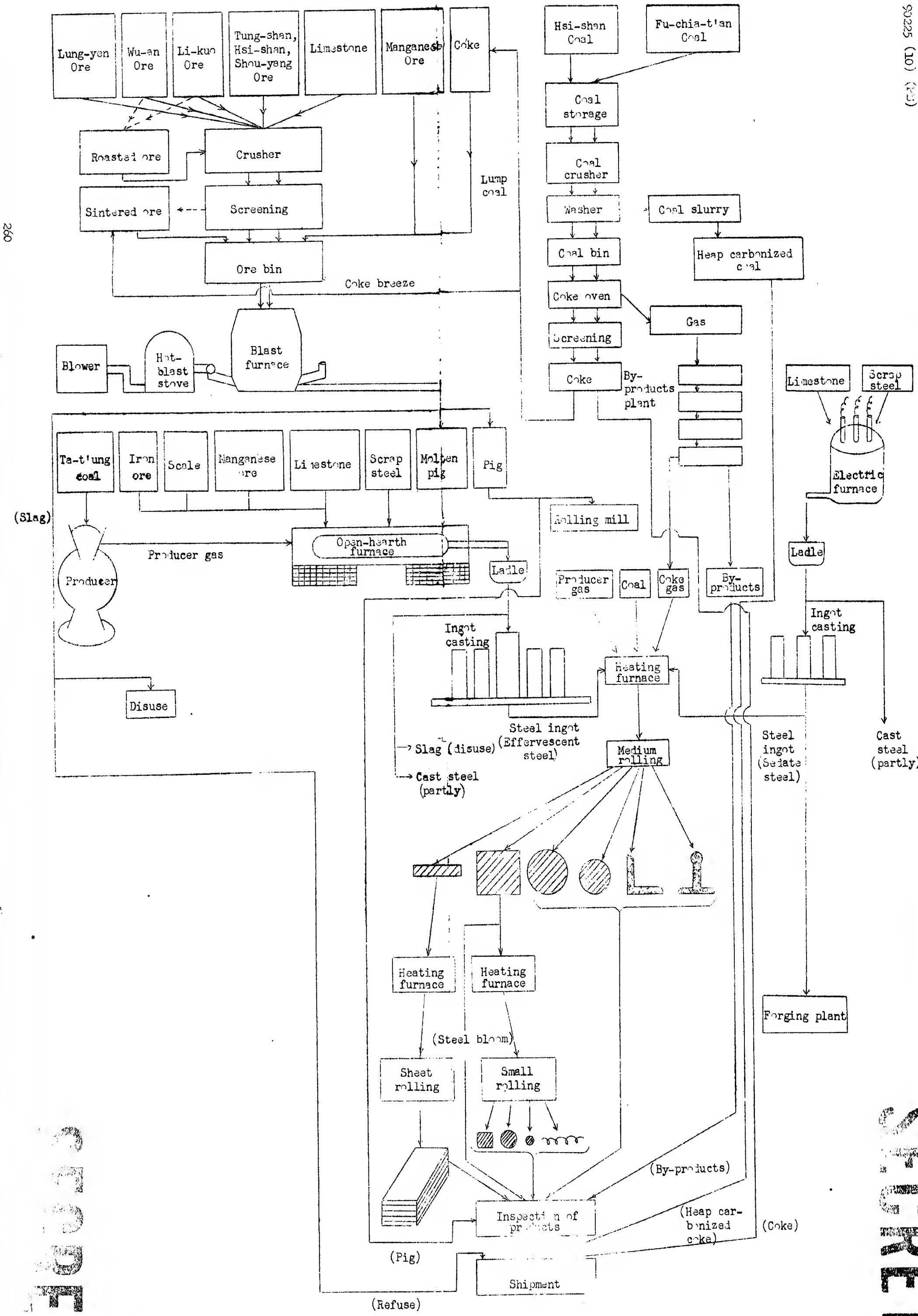

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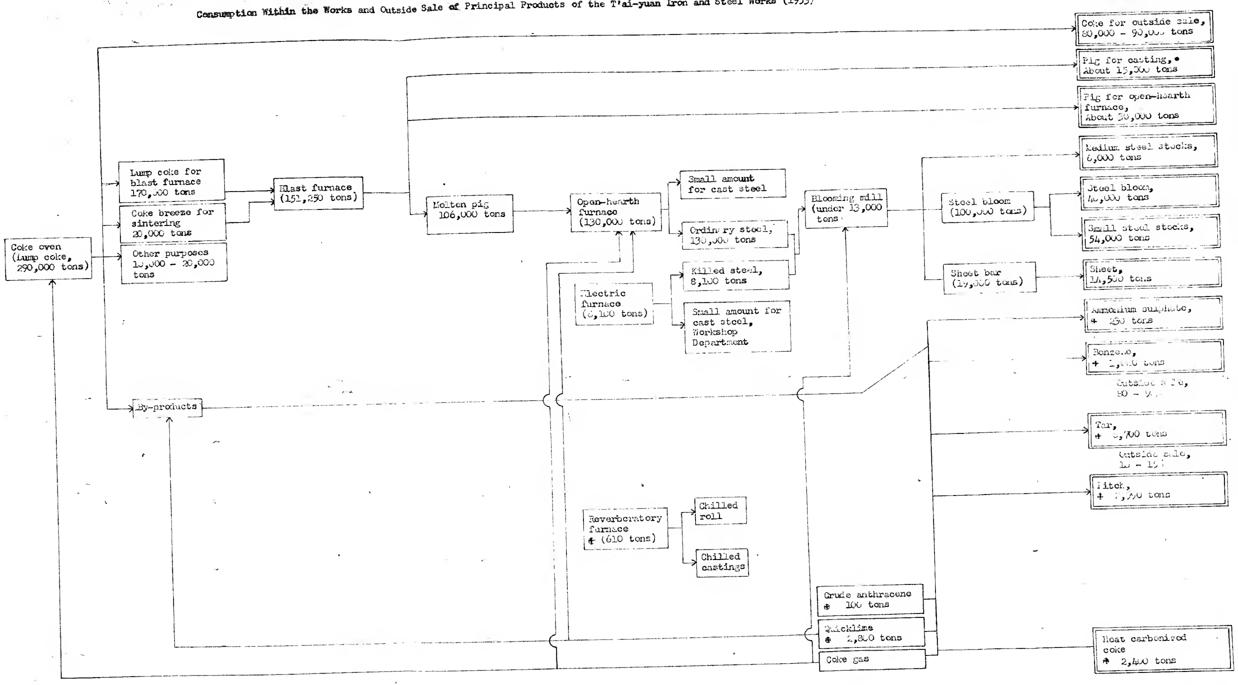
Chart No 10-4

Consumption Within the Works and Outside Sale of Principal Products of the T'ai-yuan Iron and Steel Works (1953)



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Note:

▭ Consumption within the works

▭ Outside sale

⊕ Actual result of 1952

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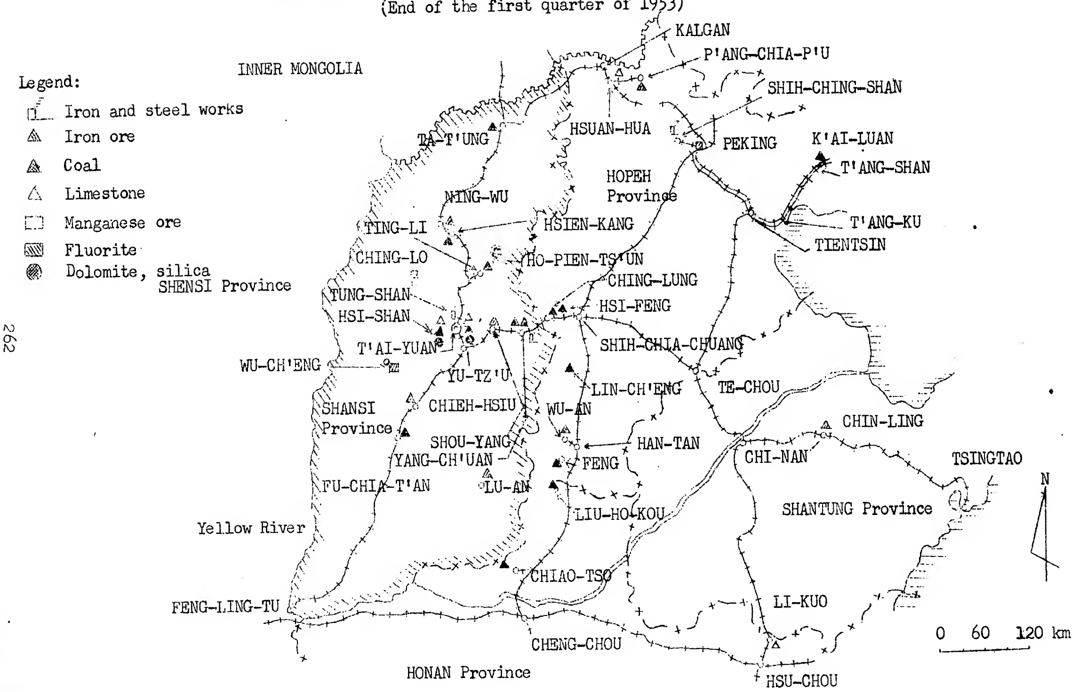
Chart No 10-5

Distribution of Mines in Operation in SHANSI and Neighboring Provinces
(End of the first quarter of 1953)



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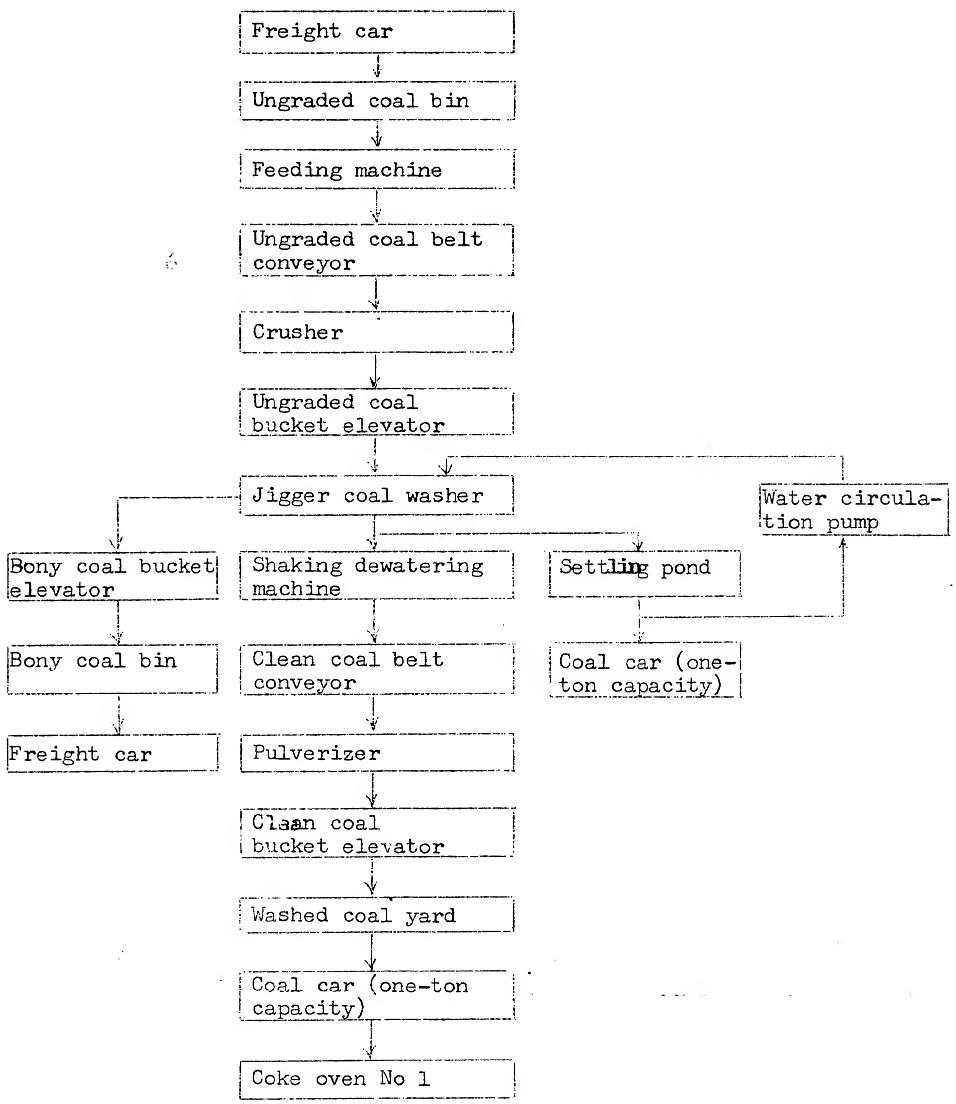
Doc No 90225 (10) (PB)

Chart No 10-7

Flow Sheet of Coal Washing Plant No 1
(August 1952)

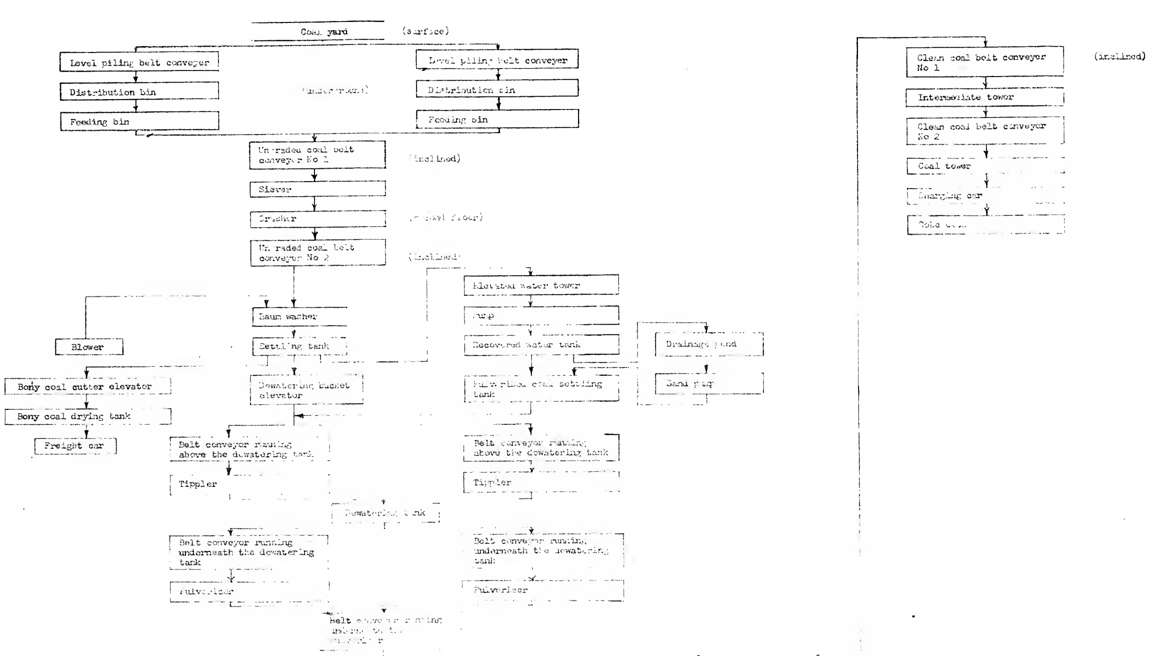
Note: Idle after September 1952



Doc No 90225 (10) (FB)

Chart No 10-8

Flow Sheet of Coal Washing Plant No 2
(End of the first quarter of 1953)



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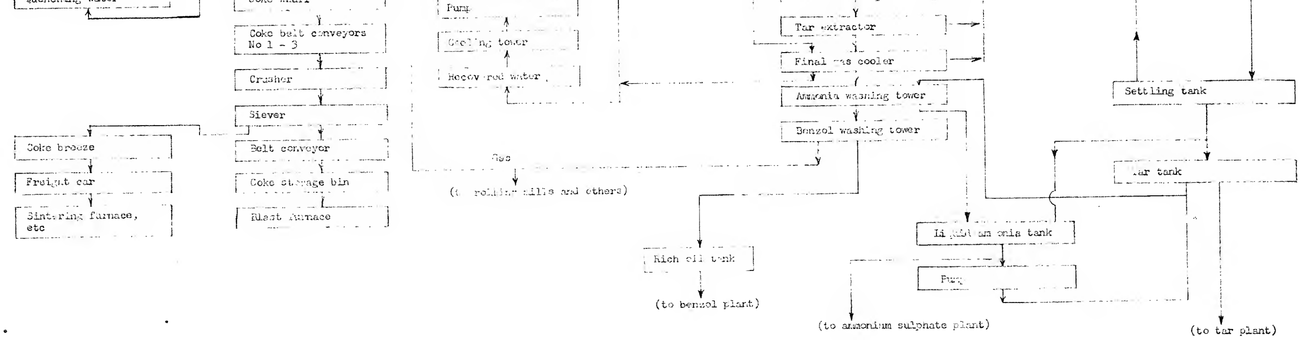
Doc No 90225 (10) (PB)

Chart No 10-9 .

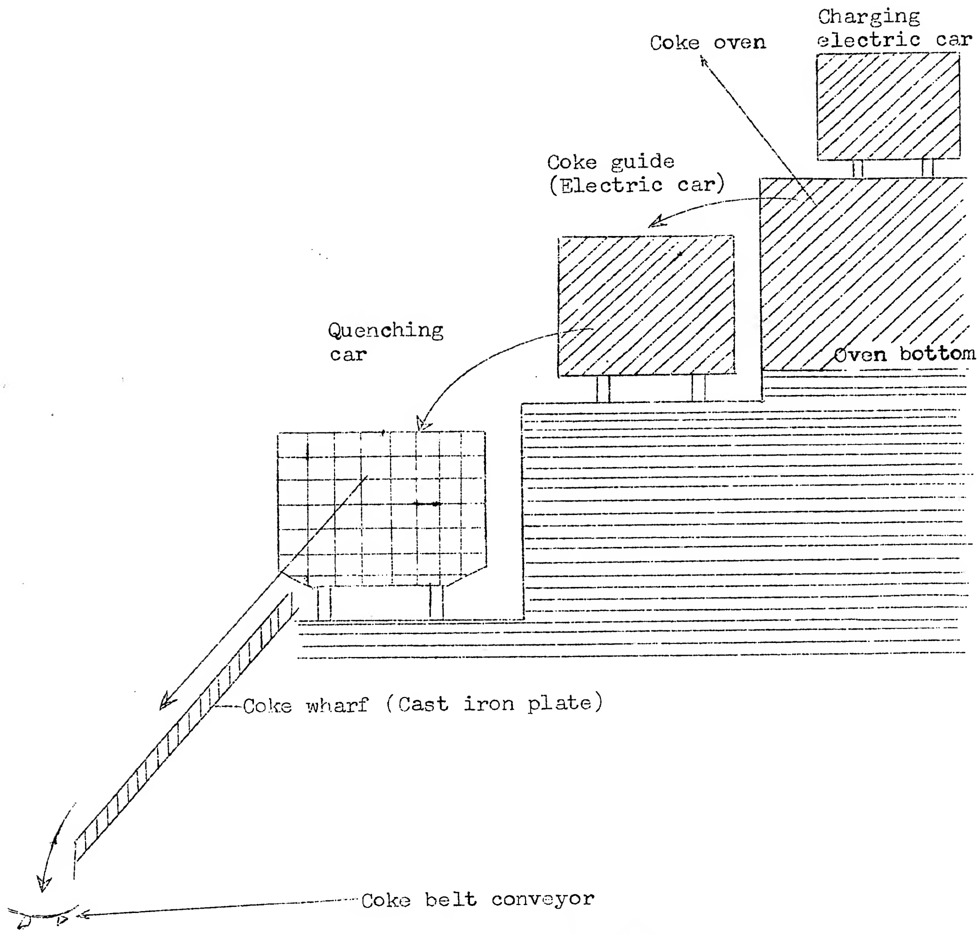
Flow Sheet of the Coking Plant
(End of the first quarter of 1953)



Doc No 90225 (10) (PB)

Chart No 10-10

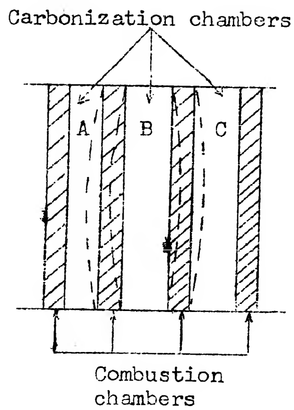
Coke Conveyance Method



Doc No 00225 (10) (PB)

Chart No 10-11

Damaged Condition of Poorly Operating Oven



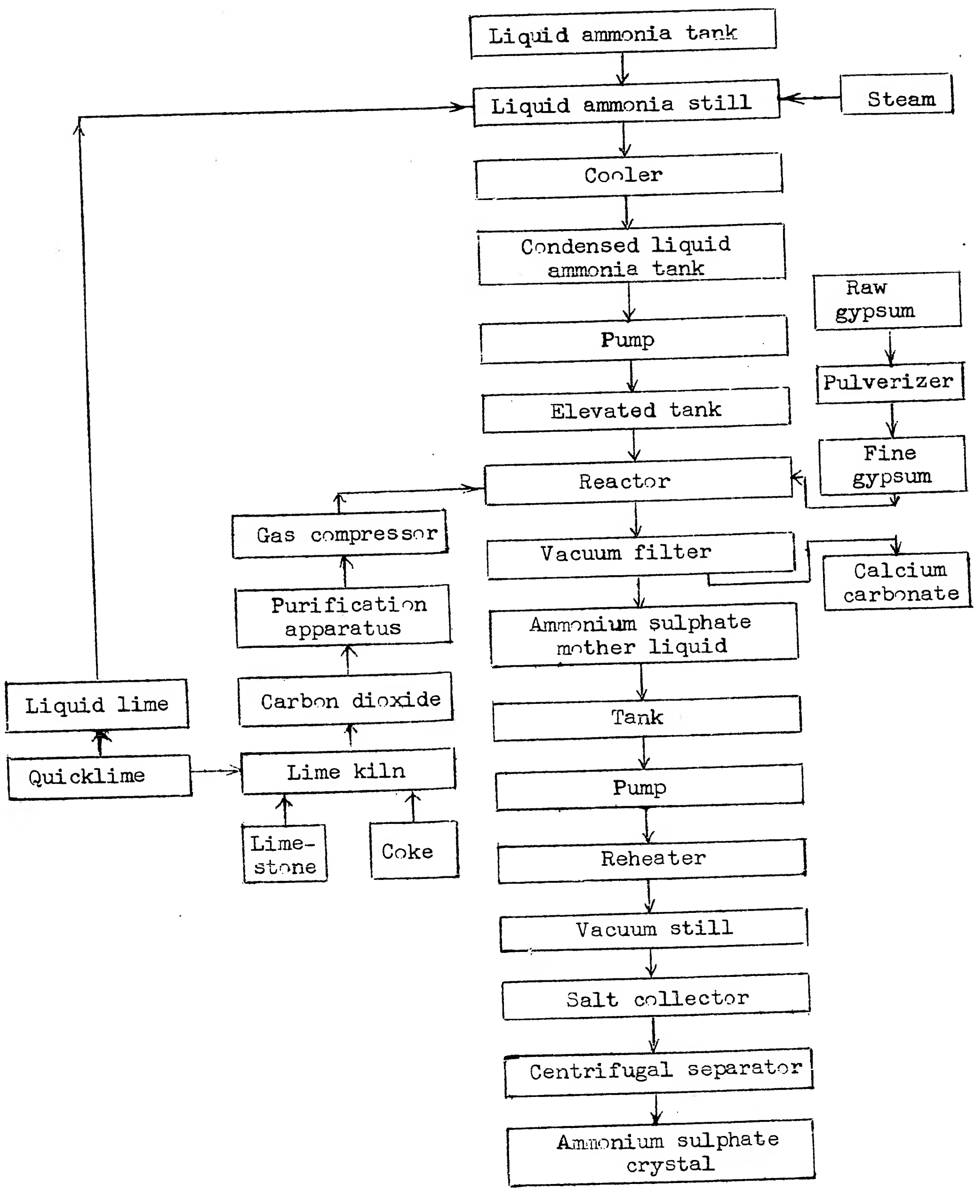
Note: Following the coking process, it was difficult to push coke out of oven B because of its great resistance and therefore, either the charging amount had to be limited or the oven had to be left as is for several days after the coking process.

There were no such hindrances in the operation of ovens A and C.

Doc No 90225 (10) (PB)

Chart No 10-12

Flow Sheet of the Ammonium Sulphate Plant
(End of the first quarter of 1953)



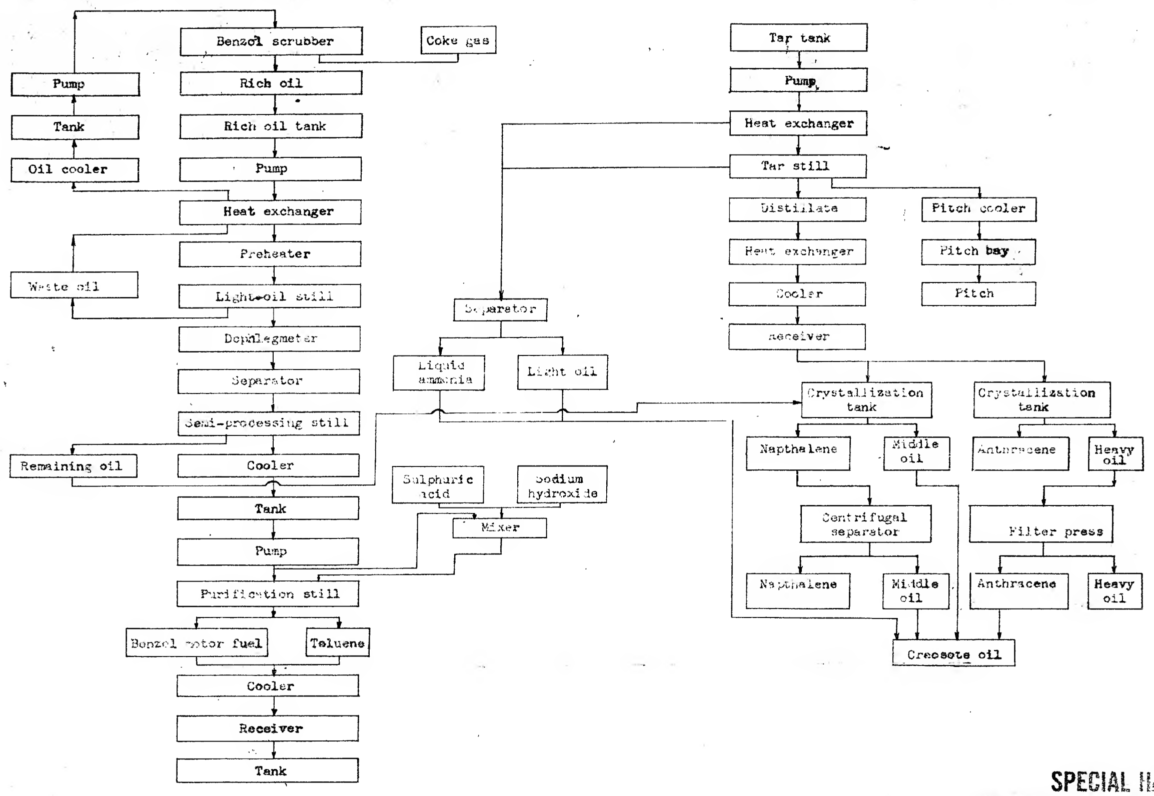
Doc No 90225 (10) (PB)

Chart No 10-13

By-products Processing System
(End of the first quarter of 1953)

Flow Sheet of the Benzol Plant

Flow Sheet of the Tar Plant



Doc No 90225 (10) (PB)

Chart No 10-14

Layout of Plant Facilities of the Pig-iron Manufacturing Department
(End of the first quarter of 1953)

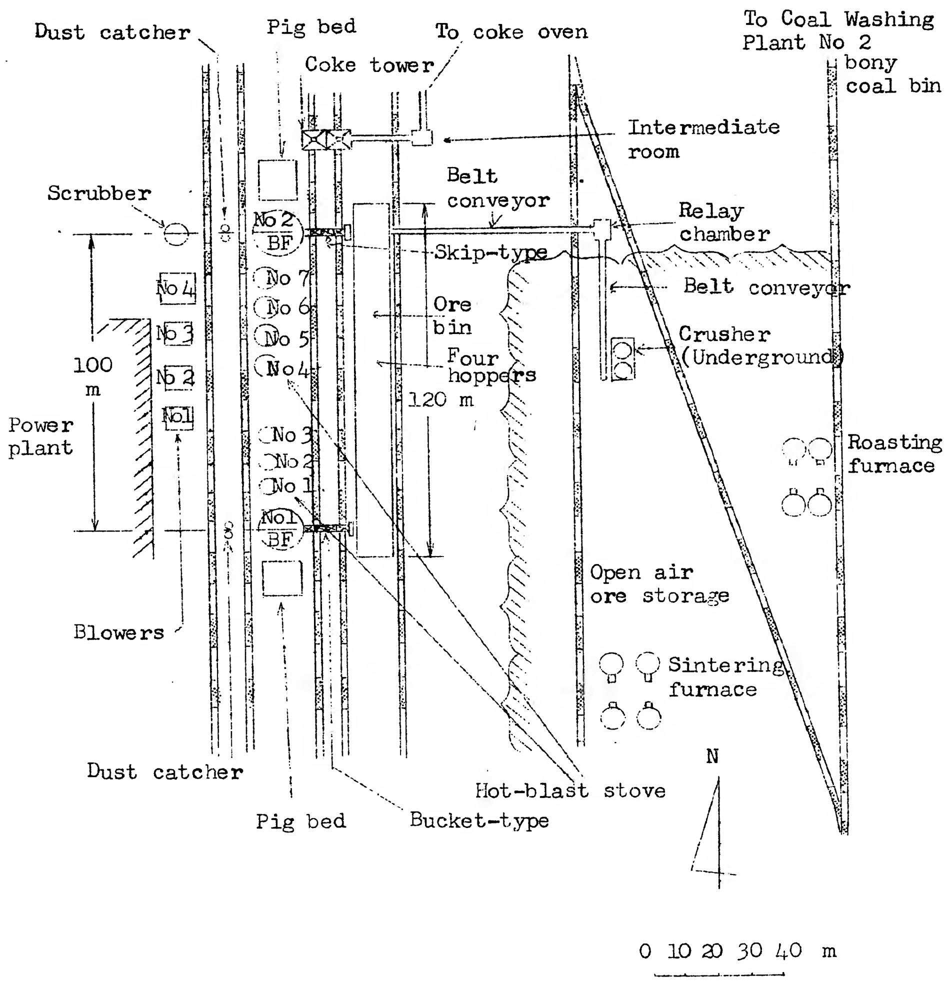


Chart No 10-15

Operational Setup of the Pig-iron Manufacturing Department (End of the first quarter of 1953)

Head of the Pig-iron Manufacturing Department

(A certain SUN /STC 1327/; ex-university professor; Age, about 50)

- Quality Control Office, production team -- several
- Blast furnace No 1 -- 21
- Blast furnace No 2 -- 30
- Casting bed team -- about 40
- Weighing team -- 2
- Hot-blast stove team -- 5 or 6
- Motive power team -- several
- Water team -- several
- Gas team -- several
- Transportation team -- about 20
- Others -- several
- Raw material section -- several tens
  - Day laborers -- about 100

Total (approximate figure)

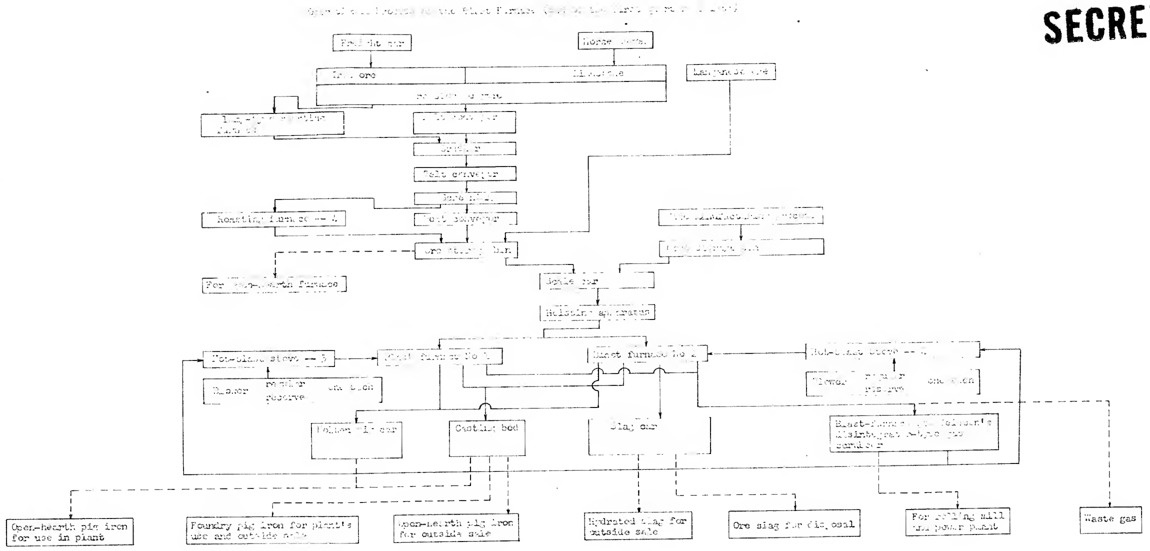
One shift:
- Regular workers -- about 200
- Day laborers -- about 100

Three shifts -- 900

Note: 1. The head of the Pig-iron Manufacturing Department was changed four times between April 1949 to late March 1953.

2. The operational system of the blast furnace plant is divided into such small teams as preparation, operation, and extraction of slag teams, but the details are unknown.

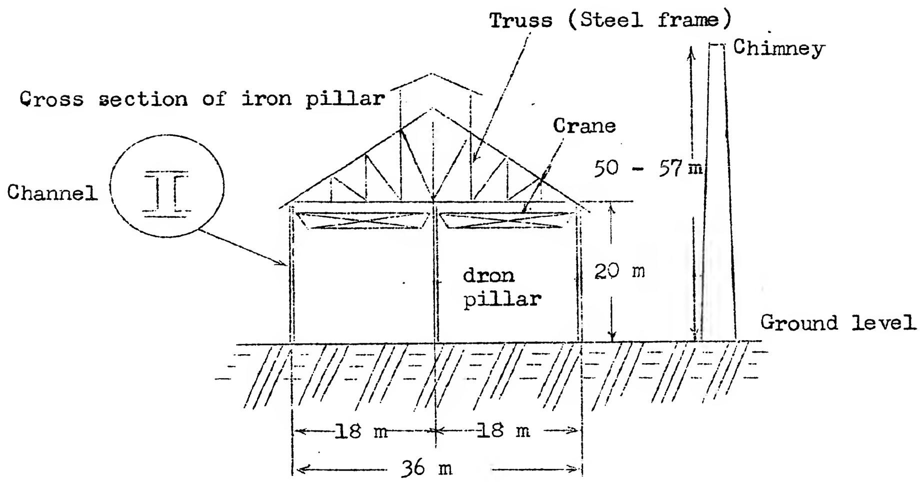
Chart No 12-16



Doc No 90225 (10) (PB)

Chart No 10-18

Cross Section of the Open-hearth Furnace Building
(End of the first quarter of 1953)



Interval between pillars -- 6.5 meters

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Doc No 90225 (10) (PB)

Structure of the 50-Ton Open-hearth Furnace
(End of the first quarter of 1953)

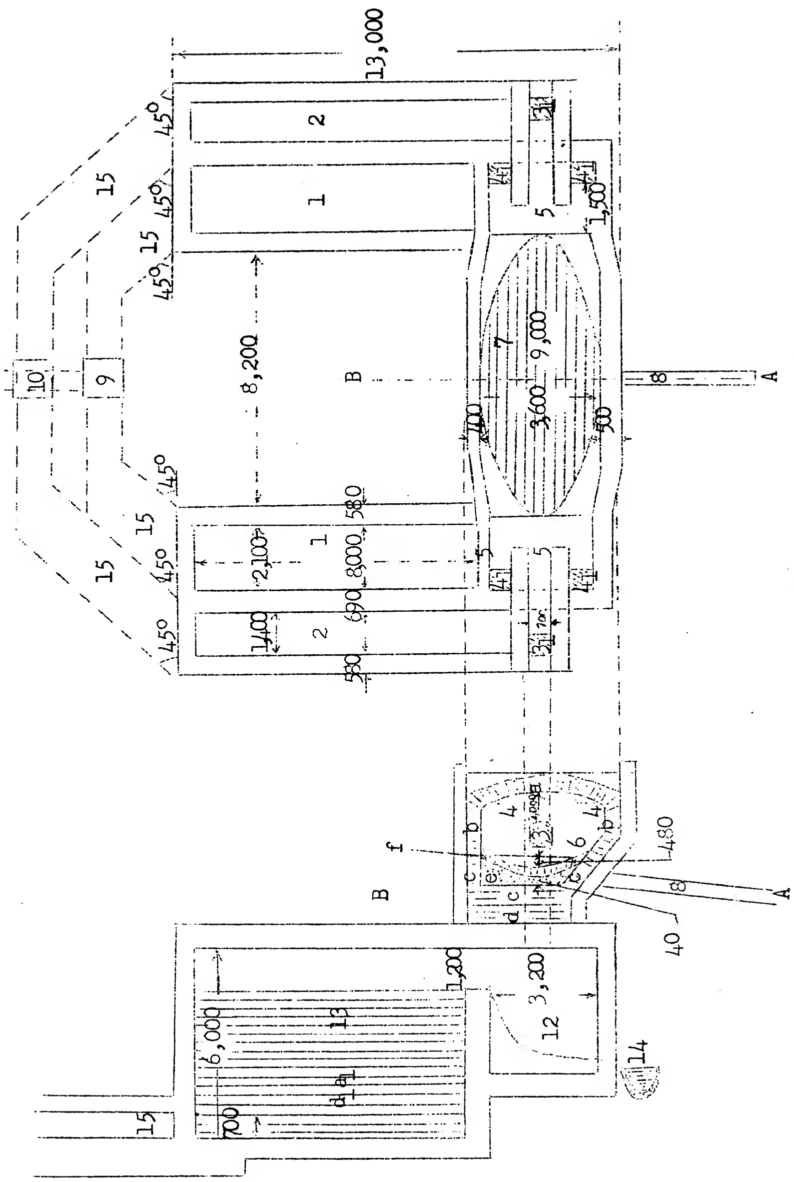

Chart No 10-19

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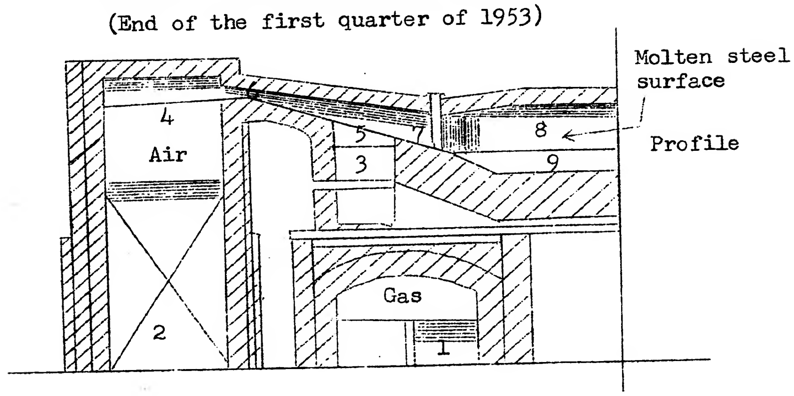
Chart No 10-19 (Cont'd)

Mark	Name
1	Air regenerator
2	Gas regenerator
3	Gas port
4	Air port
5	Combustion chamber
6	Melting chamber
7	Molten steel
8	Trough
9	Air reversing valve and blast inlet
10	Gas reversing valve
11	Flue
12	Slag chamber
13	Checkerwork of regenerator
14	Slag receiver
15	Gas and air flue
3_1	Gas uptake and downtake
4_1	Air uptake and downtake
a	Silica brick
b	Metal case
c	Chrome brick (Four layers)
d	Chamotte brick (One layer)
e	Magnesia stamp
f	Dolomite clinker
a_1	Silica brick (Checkerwork)
d_1	Chamotte brick (Three layers)

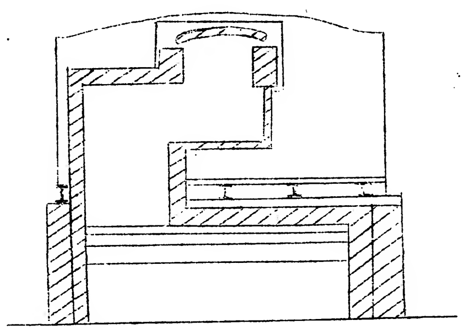
Doc No 90225 (10) (PB)

Chart No 10-20

Gas and Air Ports of the Open-hearth Furnace (Moll type)
(End of the first quarter of 1953)



Mark	Name	Mark	Name
1	Gas regenerator	6	Air port
2	Air regenerator	7	Combustion chamber
3	Gas uptake	8	Melting chamber
4	Air uptake	9	Molten steel
5	Gas port		



Side view

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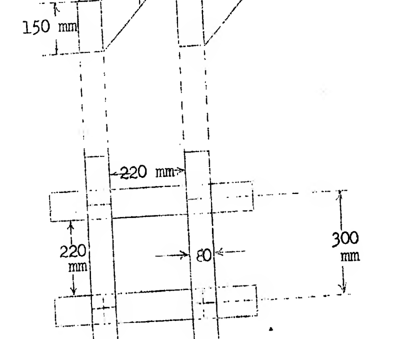
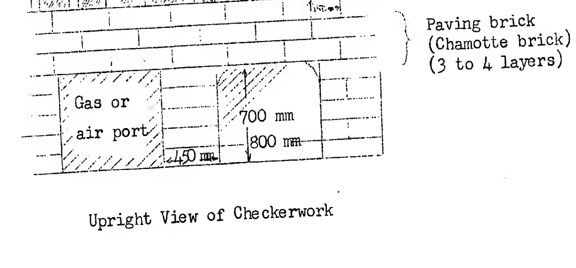
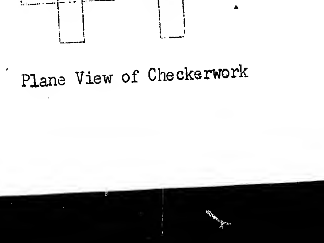
Chart No 10-21

Brick-laying Method for the Regenerator of the Open-hearth Furnace (End of the first quarter of 1953)





Upright View of Checkerwork



Plane View of Checkerwork

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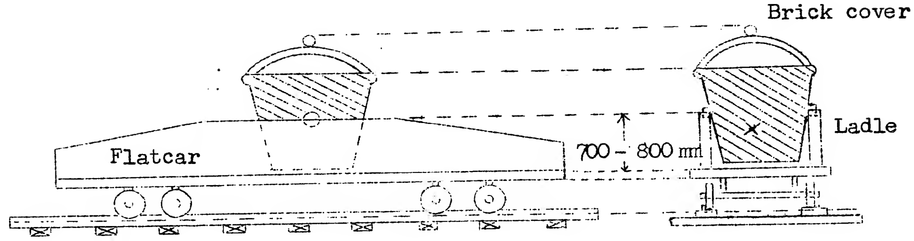
Doc No 90225 (10) (PB)

Chart No 10-22

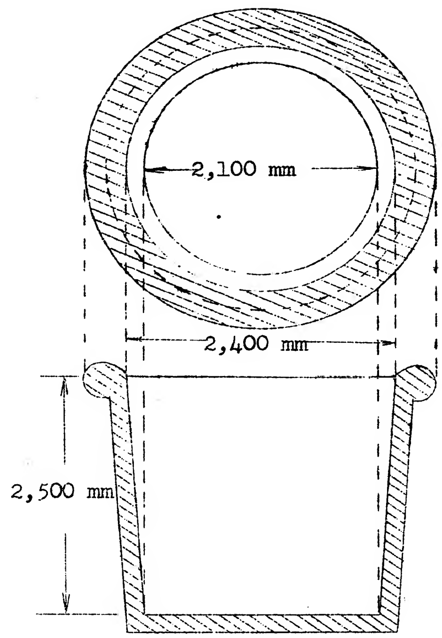
Structure of the Ladle Car
(End of the first quarter of 1953)



Doc No 90225 (10) (PB)

Chart No 10-23

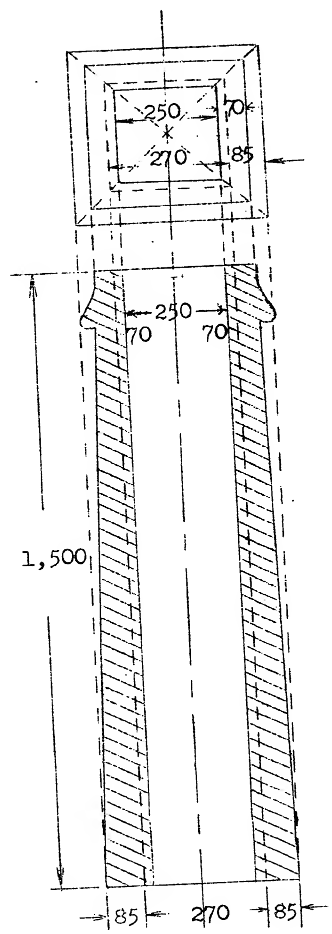
Structure of the Molten Steel Ladle
(End of the first quarter of 1953)



Doc No 90225 (10) (PB)

Chart No 10-24

Shape of the Ingot Case (680-kg) for Rimmed Steel
(End of the first quarter of 1953)



Note: The radius of curvature of the corner is unknown.

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Chart No 10-25.

Open-hearth Steel Manufacturing Process
(End of the first quarter of 1953)

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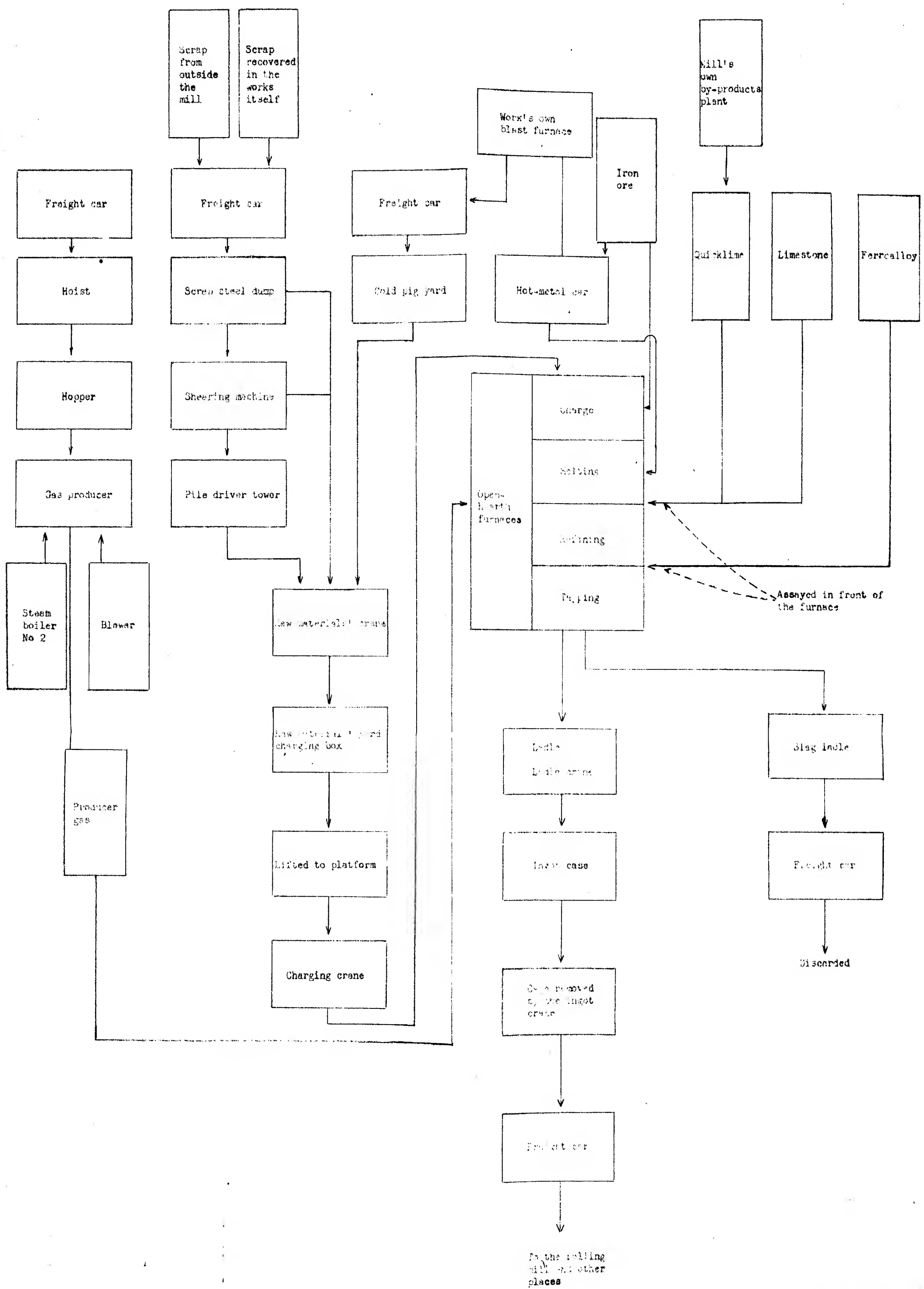

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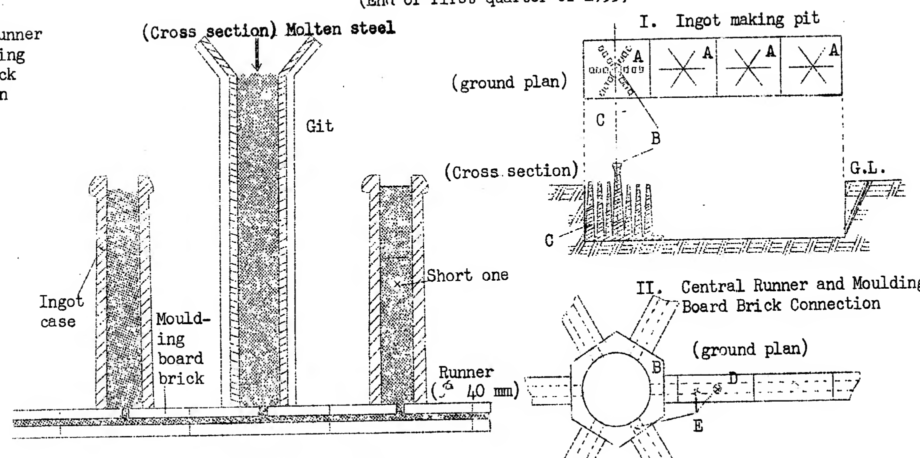
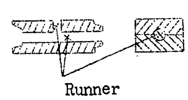
Chart No 10-26

Layout of Ingot Making (Casting) Facilities
(End of first quarter of 1953)

III. Central Runner and Moulding Board Brick Connection



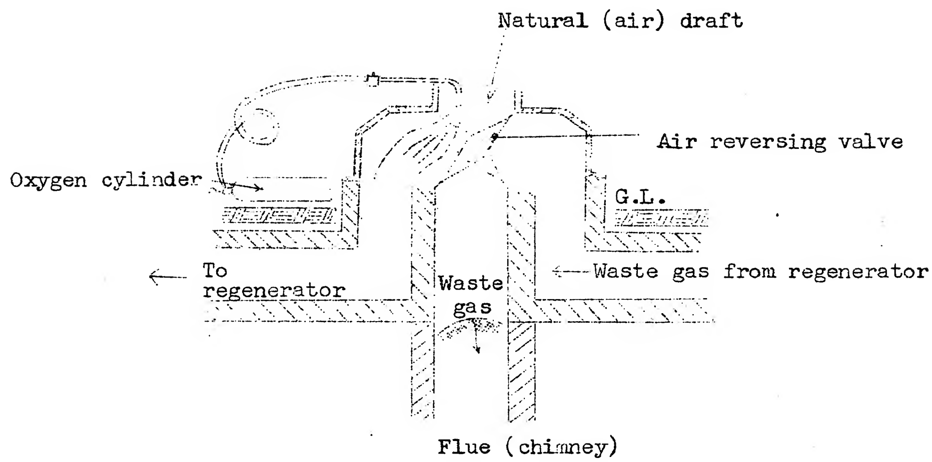


Symbol	Particular
A	Moulding board (casting bed)
B	Central runner
C	Casting mold (ingot case)
D	Moulding board brick
E	Runner

Doc No 90225 (10) (PB)

Chart No 10-27

Oxygen Supplying Device of the Open-hearth Furnace
(End of the first quarter of 1953)

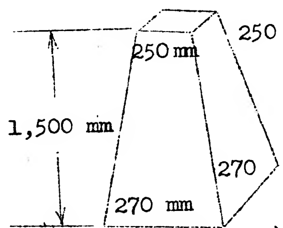


Doc No 90225 (10) (PB)

Chart No 10-28

Shape of Steel Ingot From the Open-hearth Furnace
(End of the first quarter of 1953)

Ordinary steel ingot (Rimmed steel ingot)
About 680 kg

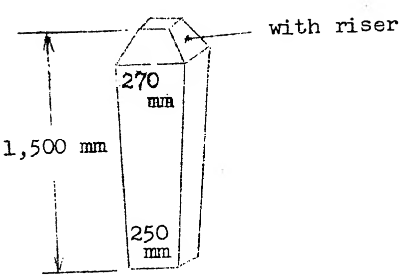


(formerly 250 mm)

(Broad-bottom type; square type)

(Structural steel ingot (Killed steel ingot)

About 650 kg

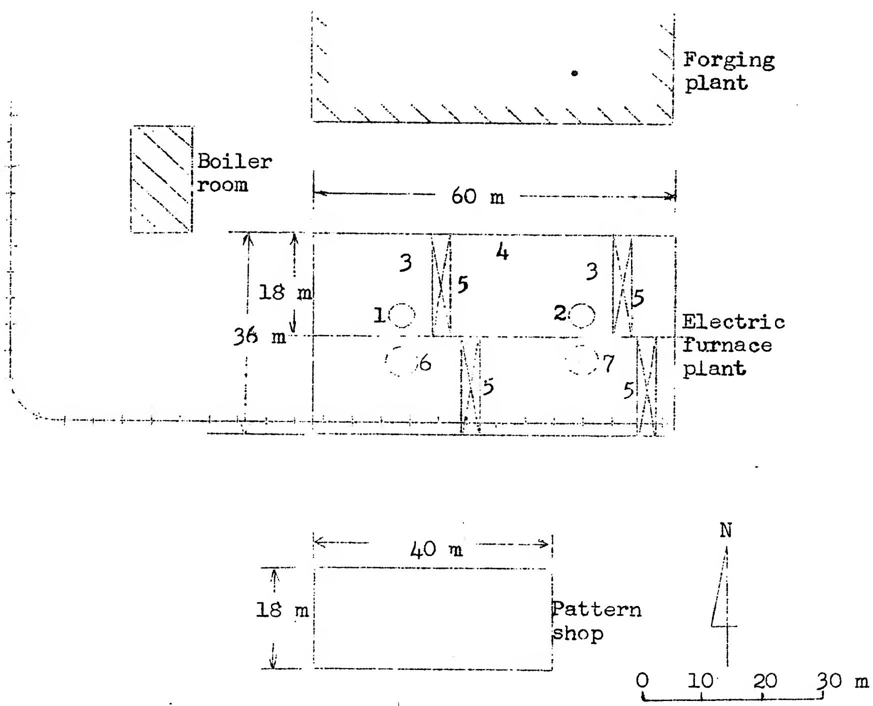


(Broad-top; square type with riser)

Doc No 90225 (10) (PB)

Chart No 10-29

Layout of the Electric Furnace Plant Facilities
(End of the first quarter of 1953)

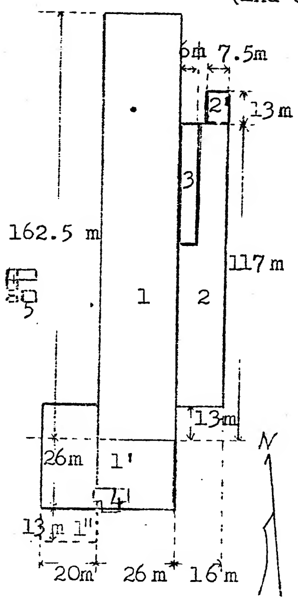


No	Designation
1	Electric furnace No 1 (3-ton)
2	Electric furnace No 2 (3-ton)
3	Molding yard
4	Annealing furnace (location unknown)
5	Crane
6	Proposed site for electric furnace No 3 (8-ton)
7	Proposed site for electric furnace No 4 (8-ton)

Doc No 90225 (10) (PB)

Chart No 10-30

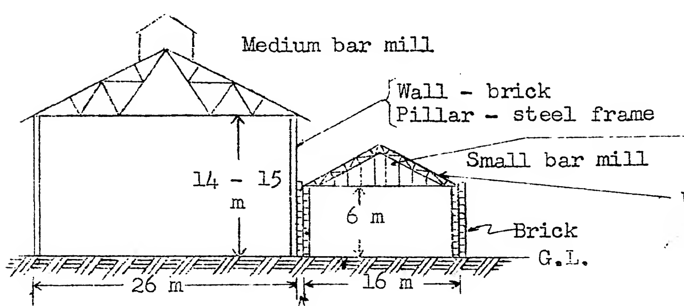
Structural Layout of the Medium and Small Bar Mills
(End of the first quarter of 1953)



1. Medium bar mill
1'. " " " (established 1952)
1". " " " (under construction in spring 1953)
2. Small bar mill
2'. " " " (established in 1952)
3. Repair shop (established in 1952)
4. Former rolling department office (removed)
4'. Newly-established office of the rolling department
5. Rolling departments' warehouse

Note: The section in thick lines indicates the buildings which were built after Chinese Communist control.

Structural Cross Section of the Medium and Small Bar Mills
(End of the first quarter of 1953)



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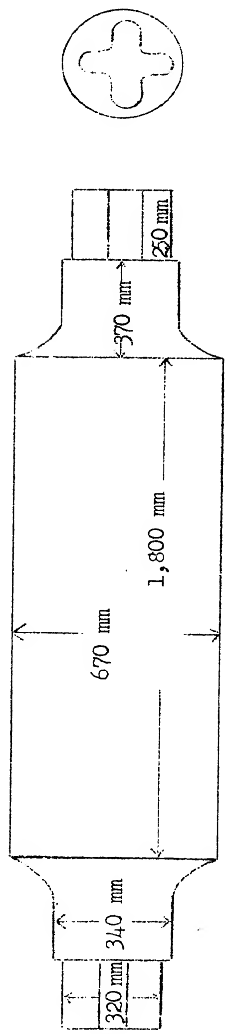

Shape of the Medium Bar Rolls

Chart No 10-32

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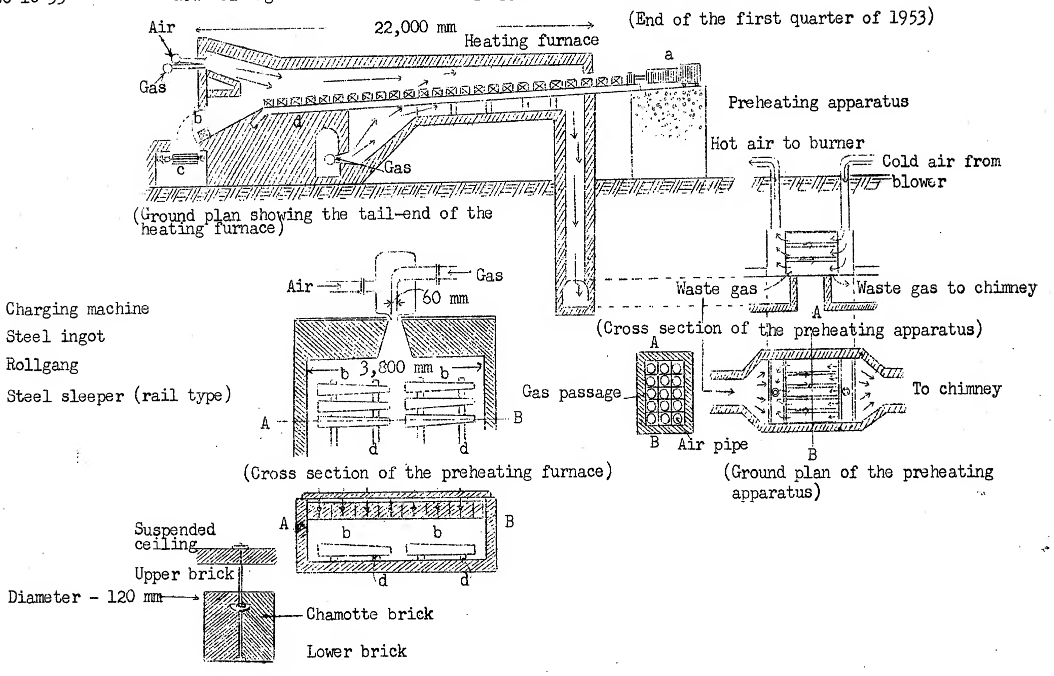
Chart No 10-33

New Heating Furnace and Preheating Apparatus for the Medium Bar Mill

(End of the first quarter of 1953)



a Charging machine
b Steel ingot
c Rollgang
d Steel sleeper (rail type)

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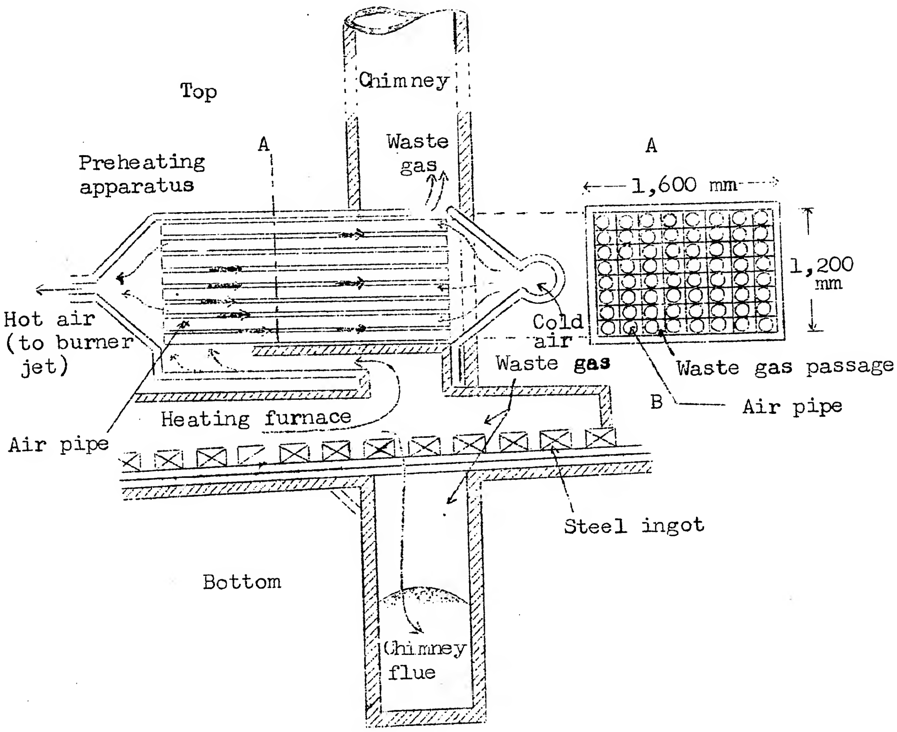
Doc No 90225 (10) (PB)

Chart No 10-34

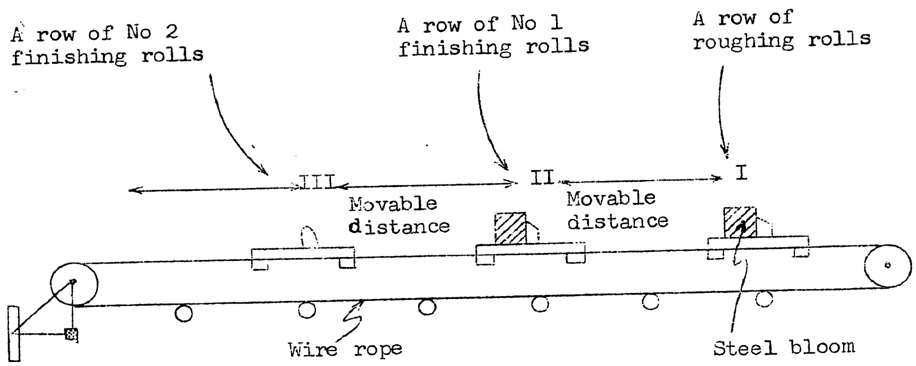
Preheating Apparatus for the Old Heating Furnace of the Medium Bar Mill
(End of the first quarter of 1953)



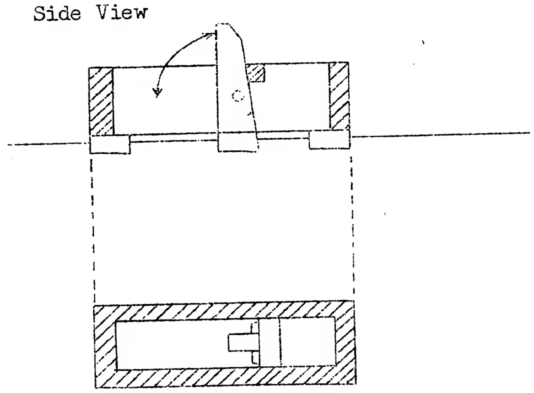
Doc No 90225 (10) (PB)

Chart No 10-35

Conveyor of the Medium Bar Mill



Side View



Ground Plan

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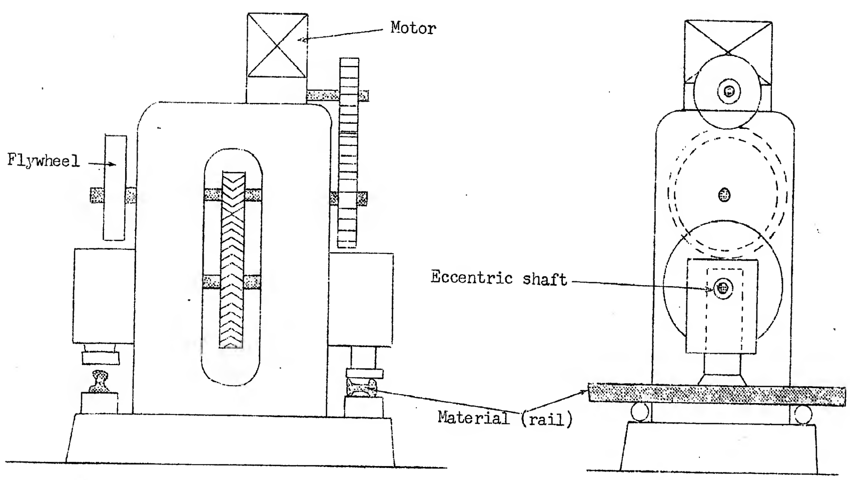
Chart No 10-36

Medium Bar Mill Press Straightener

(End of the first quarter of 1953)



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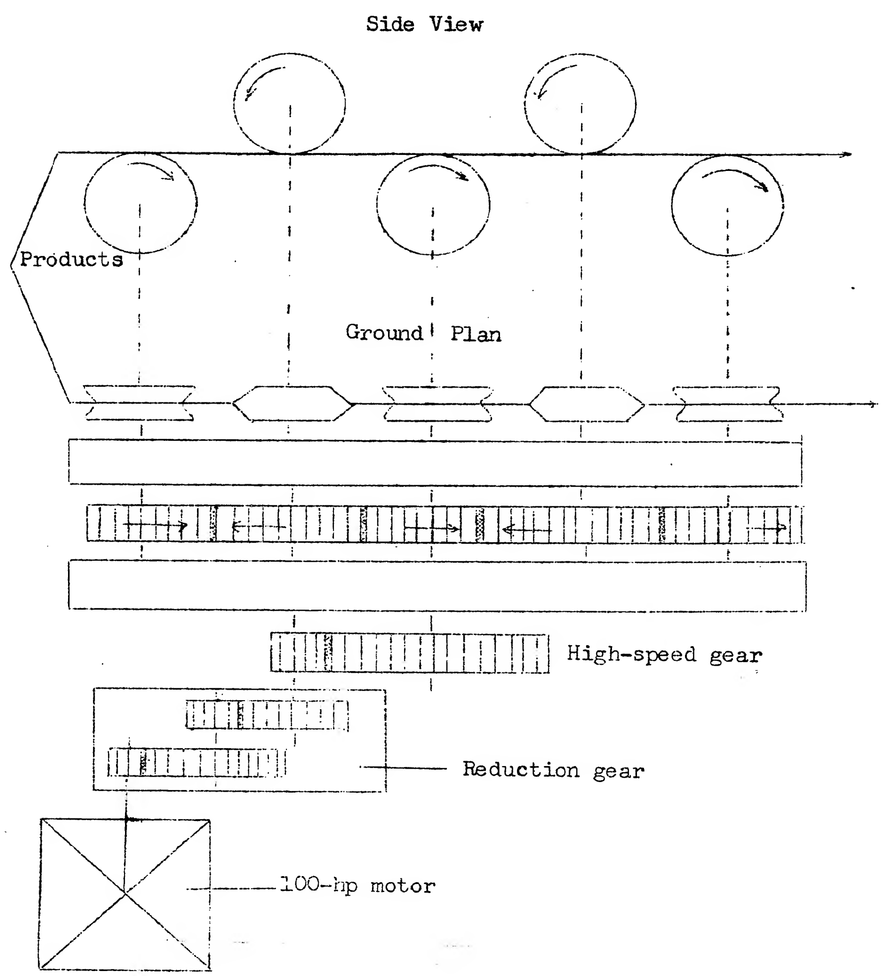
Doc No 90225 (10) (PB)

Chart No 10-37

Medium Bar Mill Roller Straightener

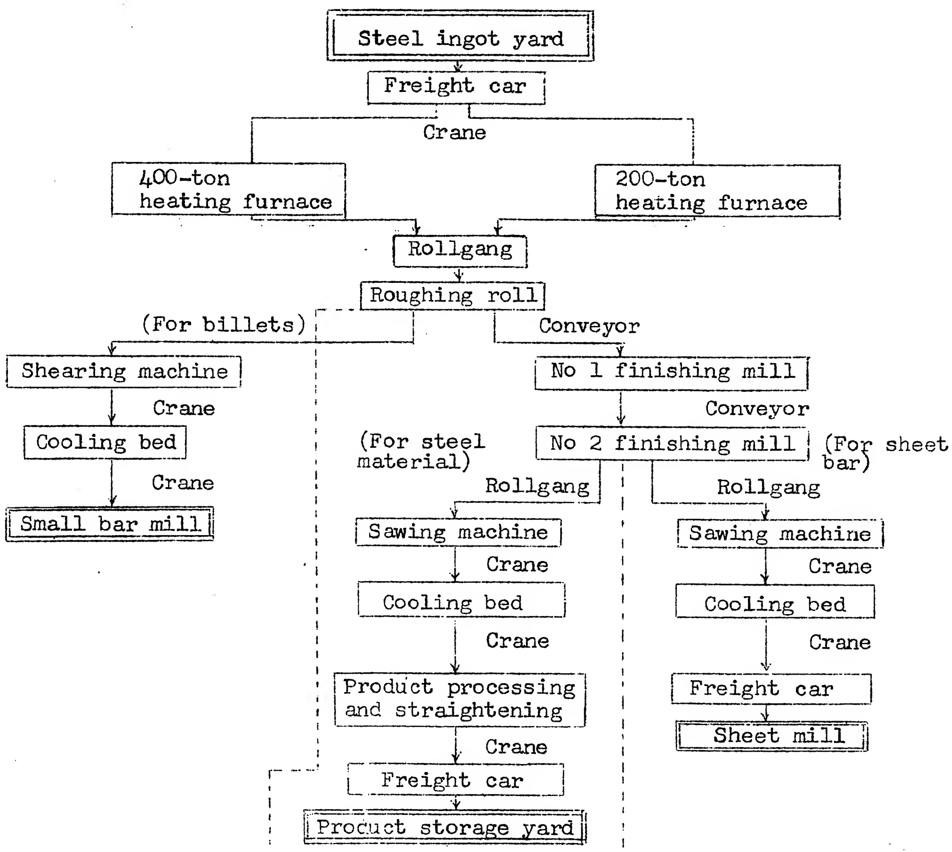
(End of the first quarter of 1953)



Doc No 90225 (10) (PB)

Chart No 10-38

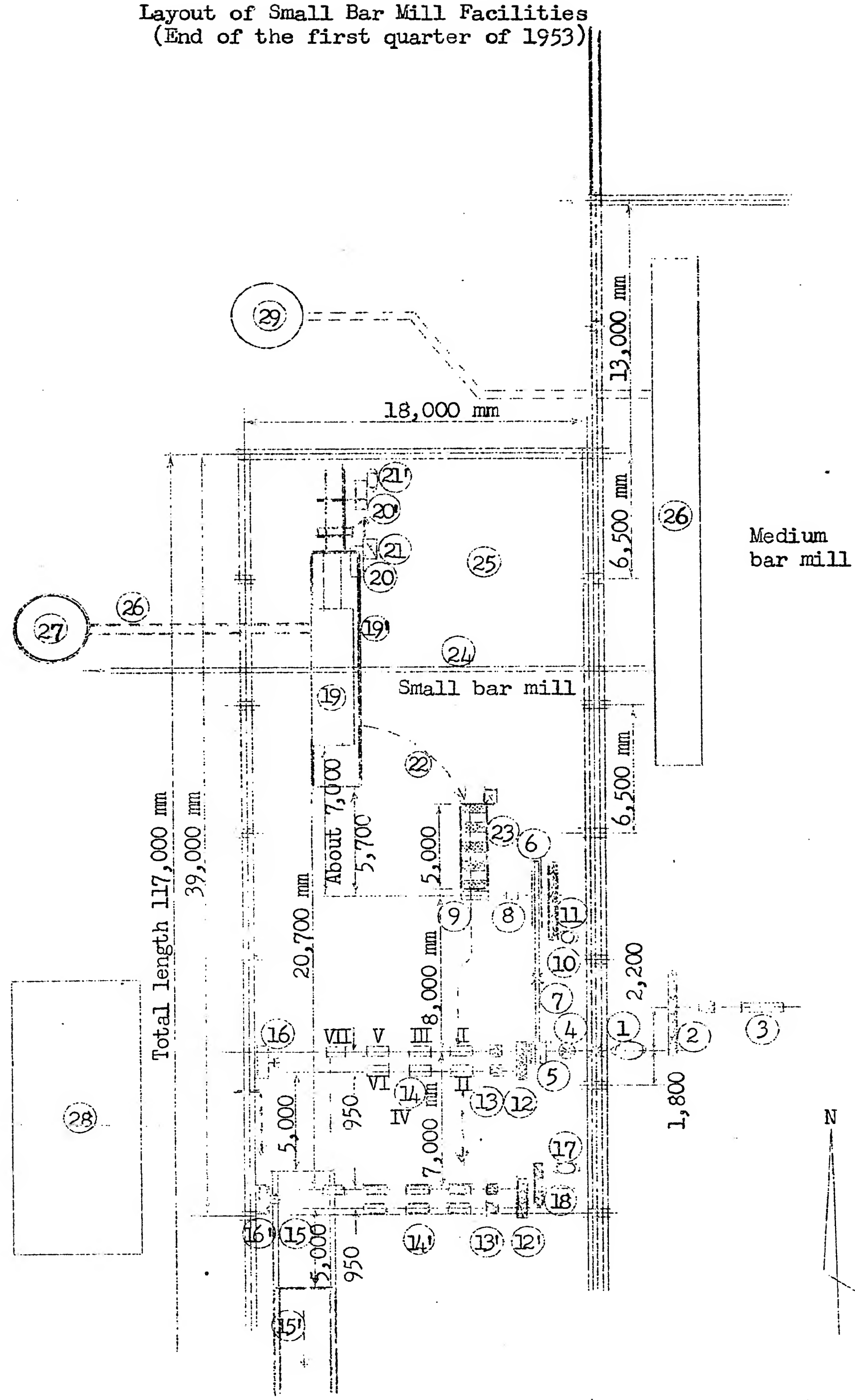
Medium Bar Rolling Process
(End of the first quarter of 1953)



Doc No 90225 (10) (PB)

Chart No 10-39

Layout of Small Bar Mill Facilities
(End of the first quarter of 1953)



Note: The thick lines shown on this chart indicate the facilities which were brought in and increased in late 1952.

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Doc No 90225 (10) (PB)

Chart No 10-39 (Cont'd)

No	Designation
1	Medium bar mill moter (Formerly it was used together with small bar mill.)
2	Reduction gear of medium bar mill
3	Medium bar roughing roll
4	Reduction gear for the old small bar mill (280 rpm)
5	Pulley for the old small bar mill (diameter, 1,200)
6	Flywheel for the old roughing roll (diameter, 3,800)
7	Cotton rope for the old universal chuck -- 7
8	Pinion for roughing roll
9	Roughing roll (three high)
10	Motor (400 hp) for the new roughing roll
11	Reduction gear (120 rpm) for the new roughing roll
12	Universal chuck gear for the old finishing roll
12'	Transfer of 12
13	The old finishing roll pinion
13'	Transfer of 13
14	The old finishing roll (I - VI are roll numbers)
14'	Transfer of 14
15	The old cooling bed
15'	Transfer of 15
16	The old reeling machine
16'	Transfer of 16
17	Finishing roll motor (1,000 hp)
18	Finishing roll reduction gear (300 rpm)
19	The old heating furnace
19'	The new heating furnace (Expansion of 19)
20	The old heating furnace charging machine
20'	Transfer of 20
21	Motor (15 hp) for the old charging machine
21'	Transfer of 21
22	Suspension lever
23	Rollgang
24	Coke gas pipe (diameter, 10 inches; five meters above the ground; 450 meters to coke plant)
25	Billet yard
26	The new flue (underground)
27	The new chimney
28	Wire rod yard (outdoor)
29	The medium bar mill chimney

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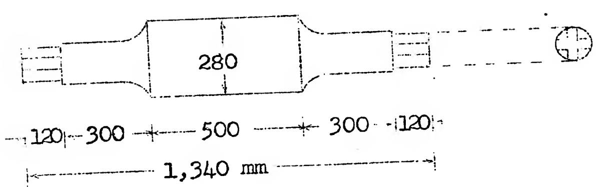
Chart No 10-40

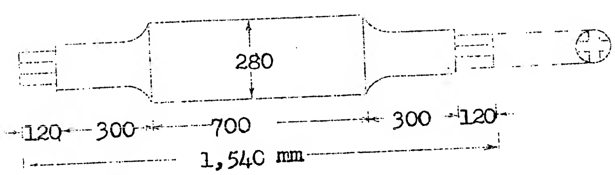
Shape of the Small Bar Finishing Roll

Former (German) Copper Plate Roll

Note: Caliber omitted



Japanese Roll



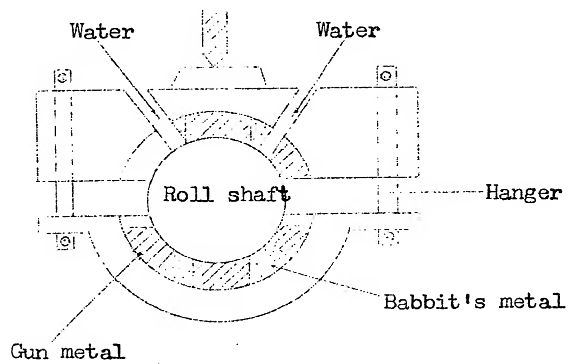
Doc No 90225 (10) (PB)

Chart No 10-41

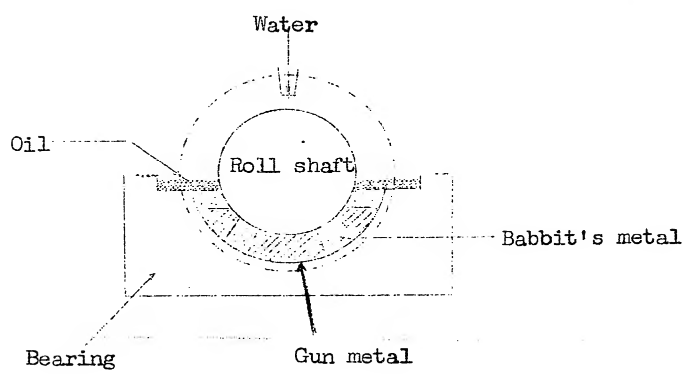
Small Bar Mill Roll Bearing

Upeer Roll Hanger

Note: The synthetic resinous metal is widely used in JAPAN as the latest new method. In this new method, oil is not used, water alone is sufficient.



Lower Roll Bearing



Doc No 90225 (10) (PB)

Chart No 10-42

Installation of the Small Bar Finishing Roll
(End of the first quarter of 1953)

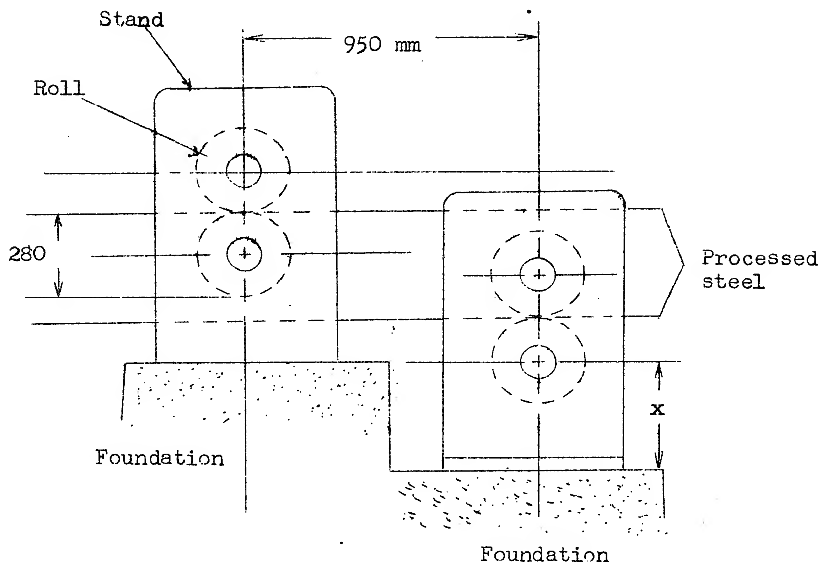
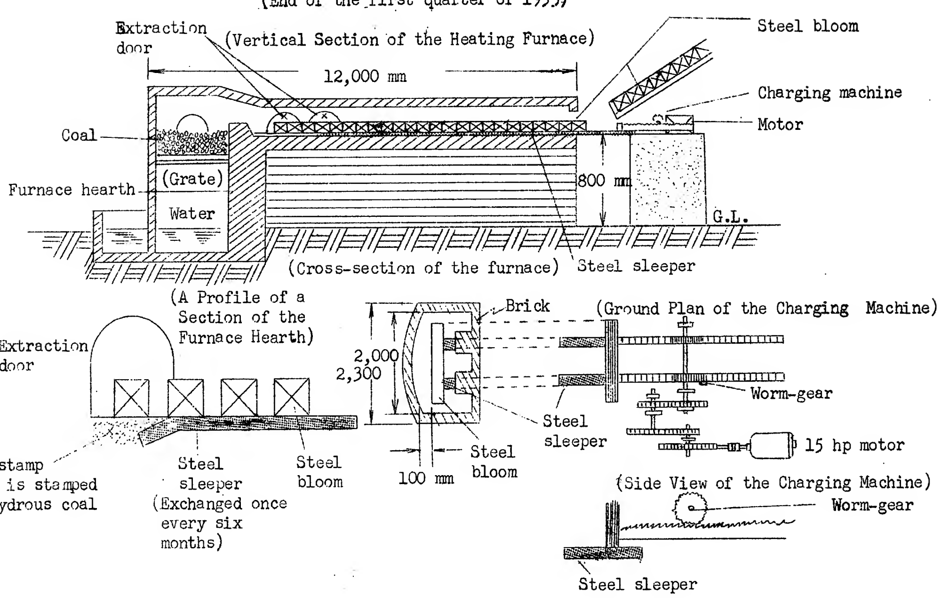


Chart No 10-43

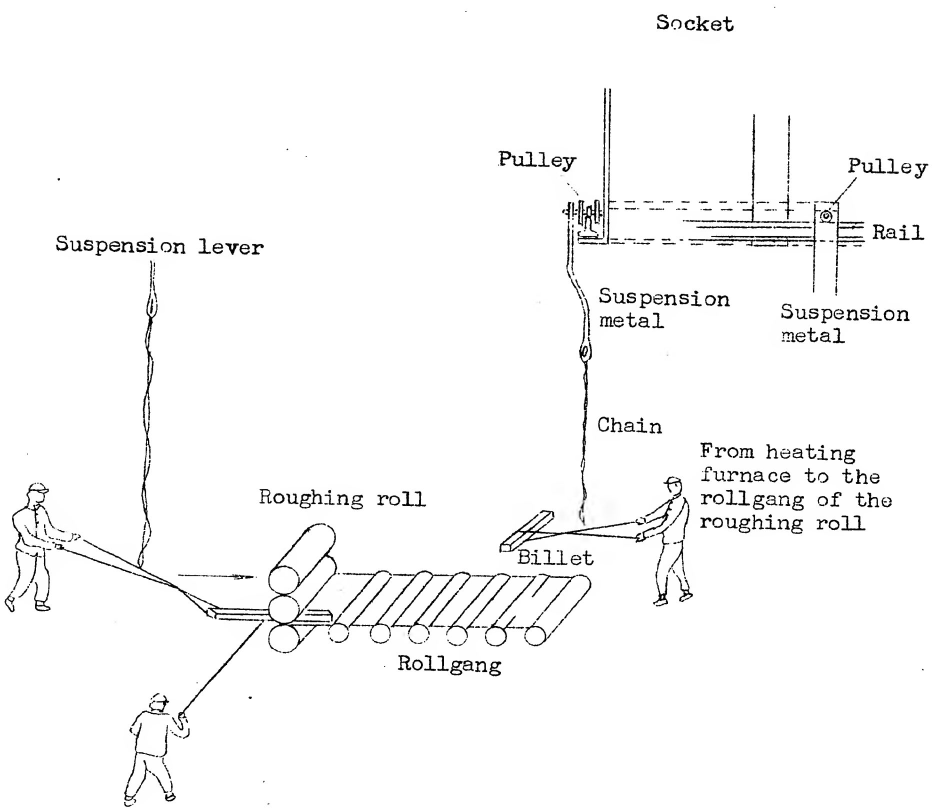
Heating Furnace of the Small Bar Mill
(End of the first quarter of 1953)



Doc No 90225 (10) (PB)

Chart No 10-44

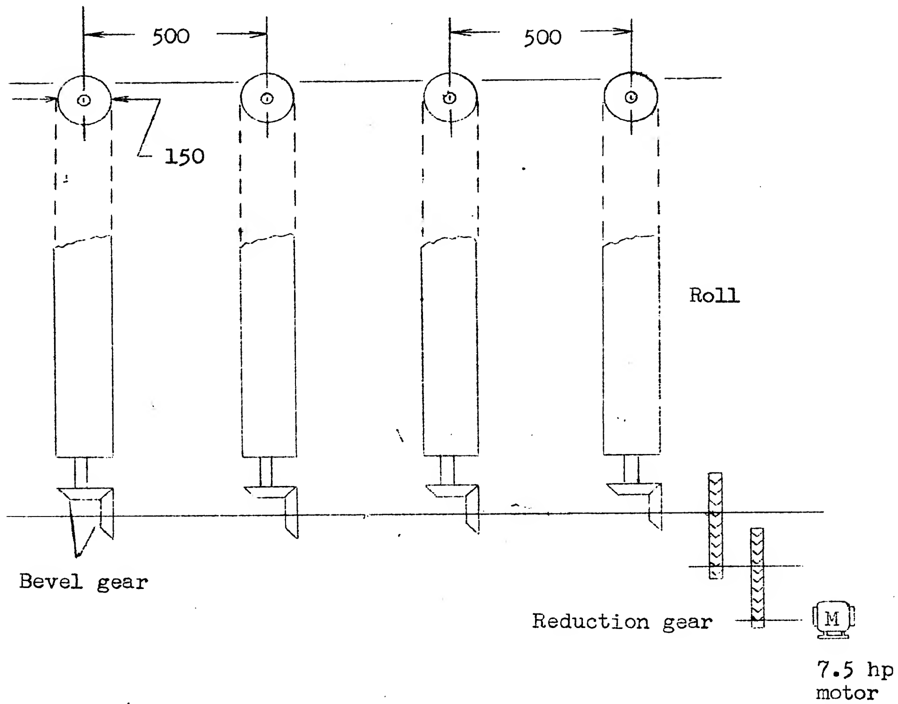
Operation of the Suspension Lever for Small Bar Rolling
(End of the first quarter of 1953)



Doc No 90225 (10) (PB)

Chart No 10-45

Structure of the Rollgang for the Small Bar Roughing Roll
(End of the first quarter of 1953)



(Interlocking device is set up underground.)

Chart No 10-46

Structure of the Cooling Bed of the Small Bar Mill
(End of the first quarter of 1953)

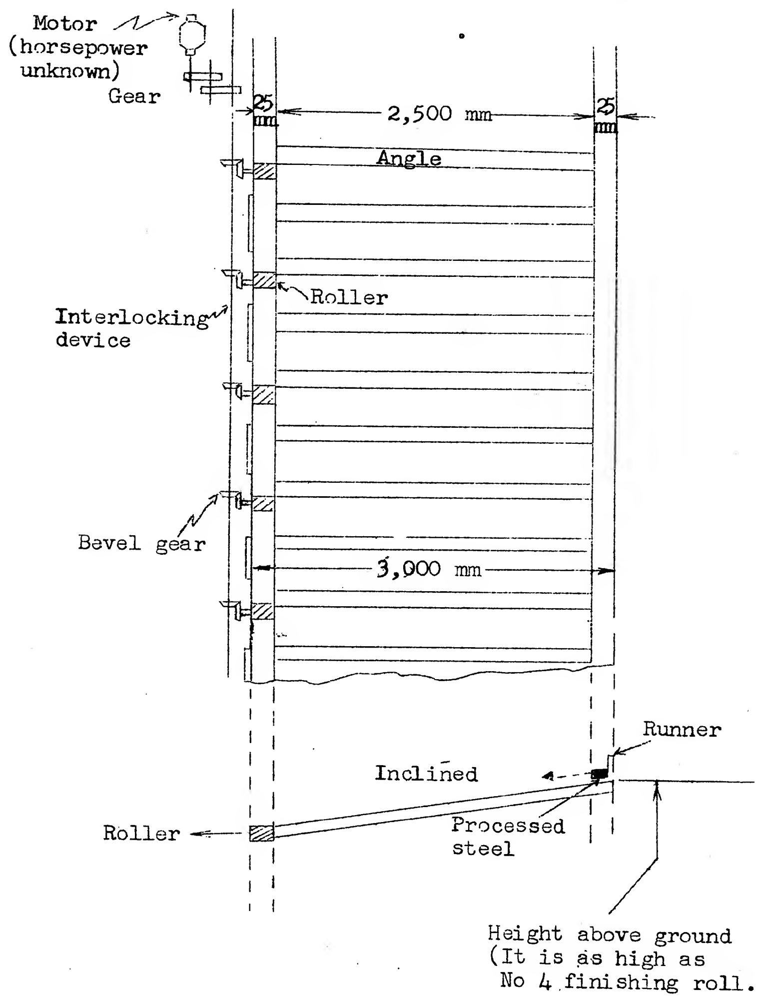


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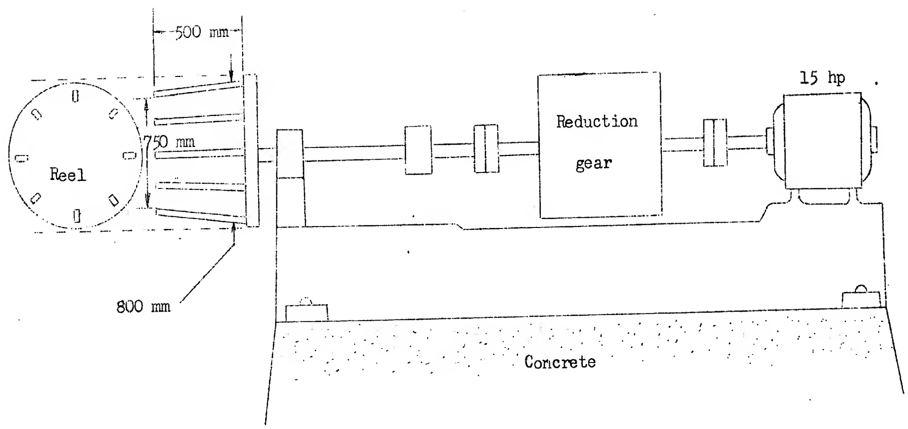
Chart No 10-47

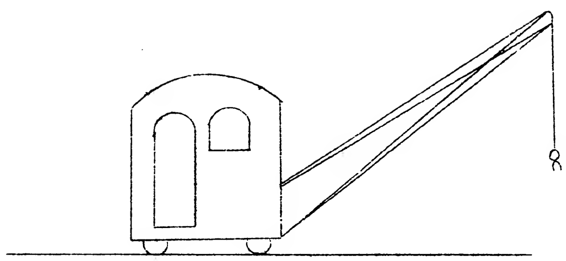
Winders of the Small Bar Roll



Doc No 90225 (10) (PB)

Chart No 10-48

Portable Ground Crane



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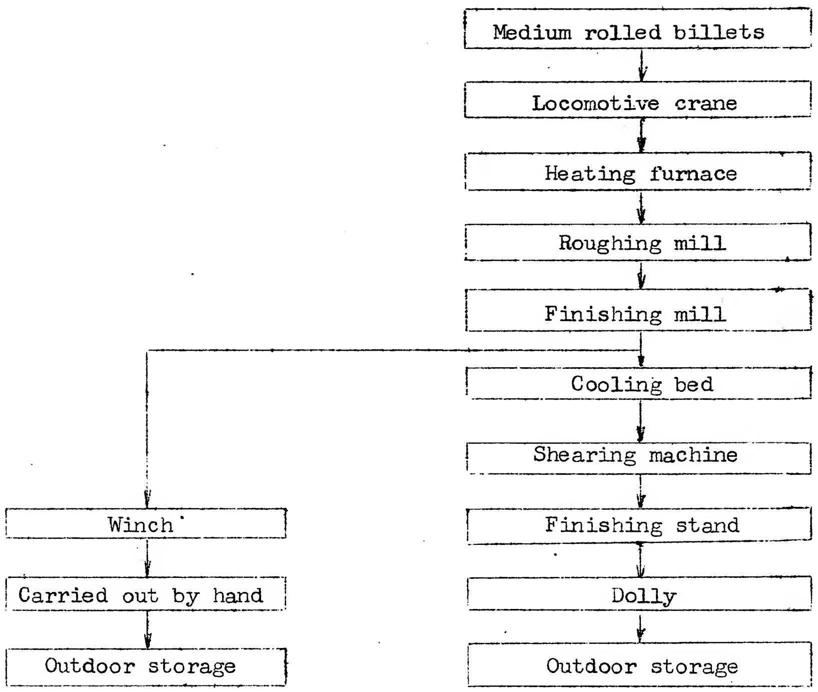
Doc No 90225 (10) (PB)

Chart No 10-49

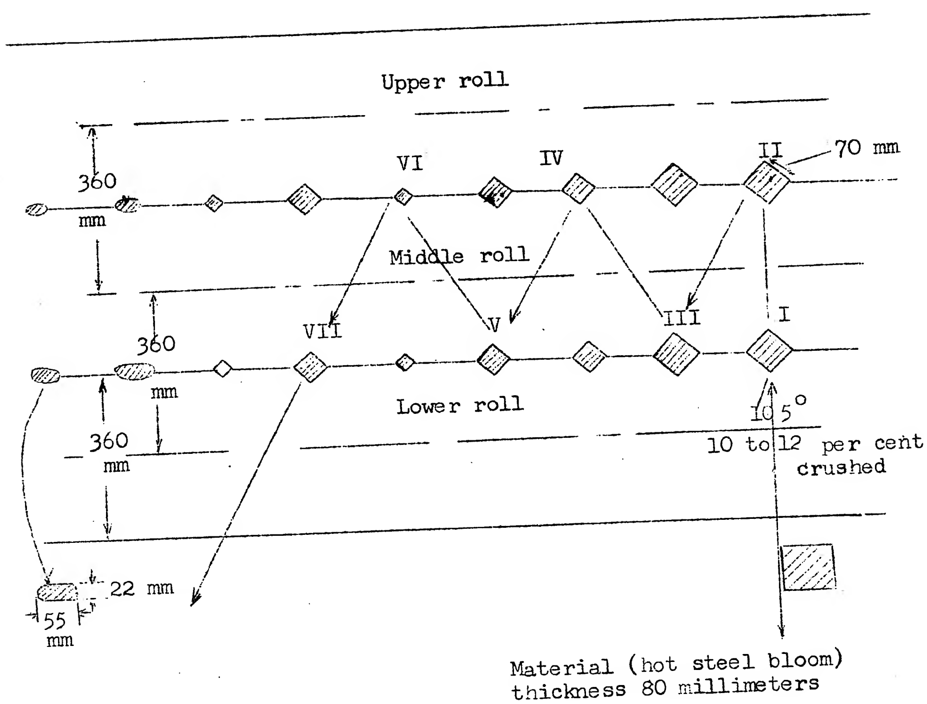
Operational Process for Small Bar Rolling
(End of the first quarter of 1953)



Doc No 90225 (10) (PB)

Chart No 10-50

Small Bar Roughing Roll Pass and Operational Process



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Doc No 90225 (10) (PB)

Small Bar Finishing Roll Pass and Operational Process

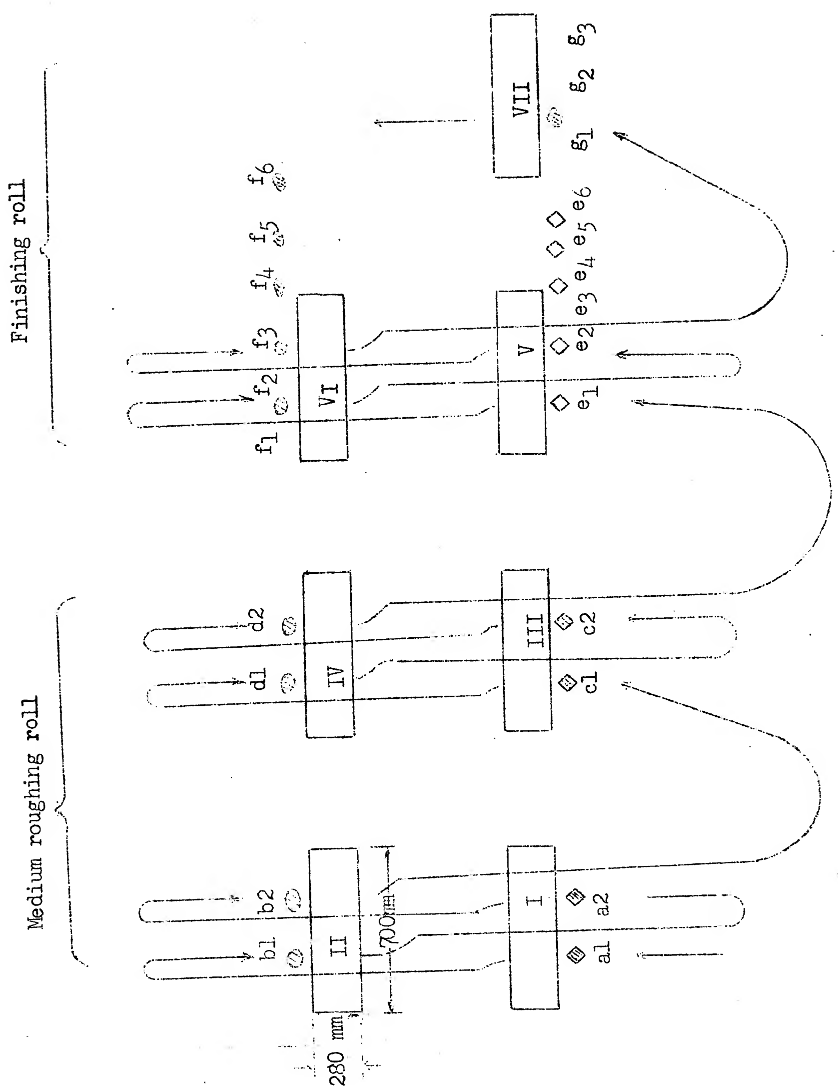

Chart No 10-51

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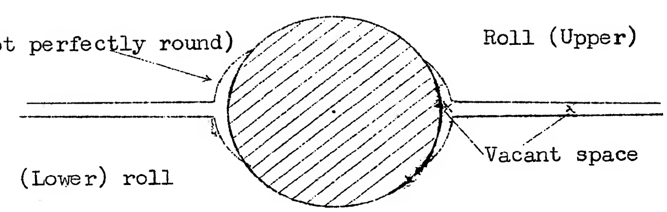
Doc No 90225 (10) (PB)

Chart No 10-52

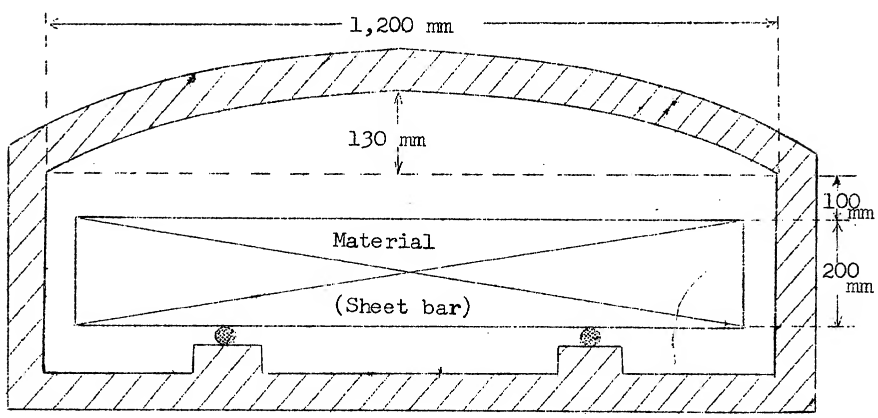
Finishing Pass of Roll No 7



Doc No 90225 (10) (PB)

Chart No 10-54

Cross-section of the Heating Furnace of the Sheet Mill
(End of the first quarter of 1953)



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Doc No 90225 (10) (PB)

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Chart No 10-55

Cross-section of the Foil Sheet Furnace of the Sheet Mill
(End of the first quarter of 1953)

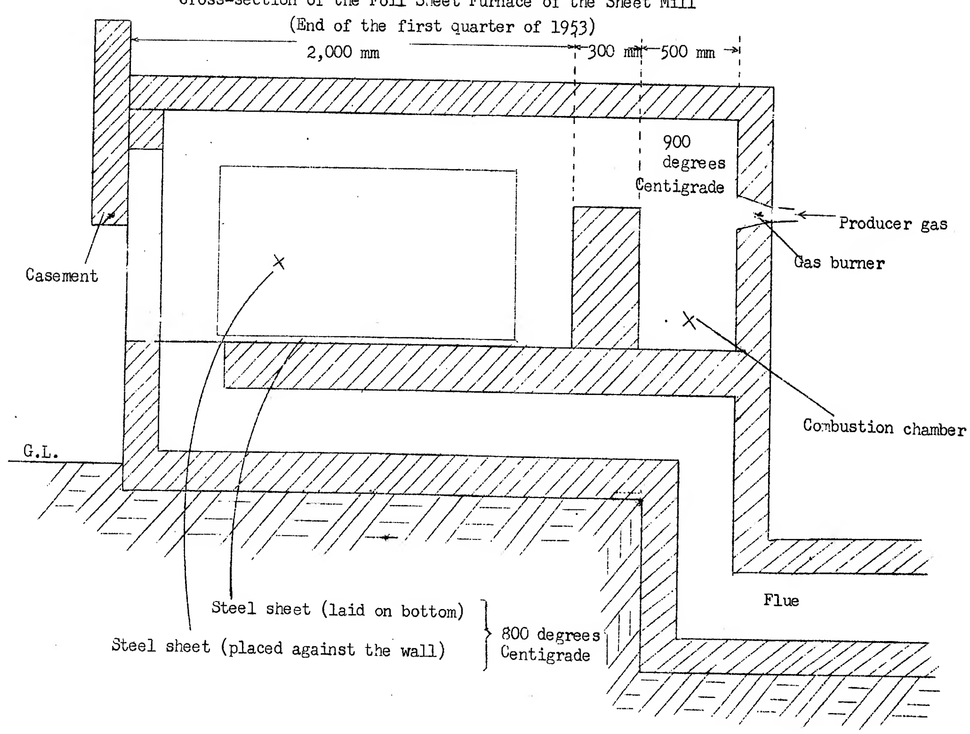

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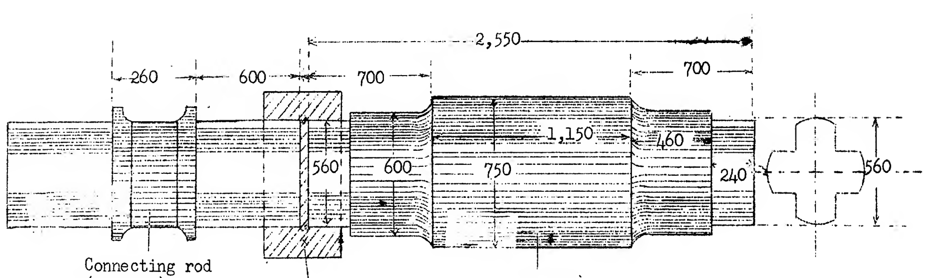
Chart No 10-56

Sheet Roll Coupling Precedure
(End of the first quarter of 1953)



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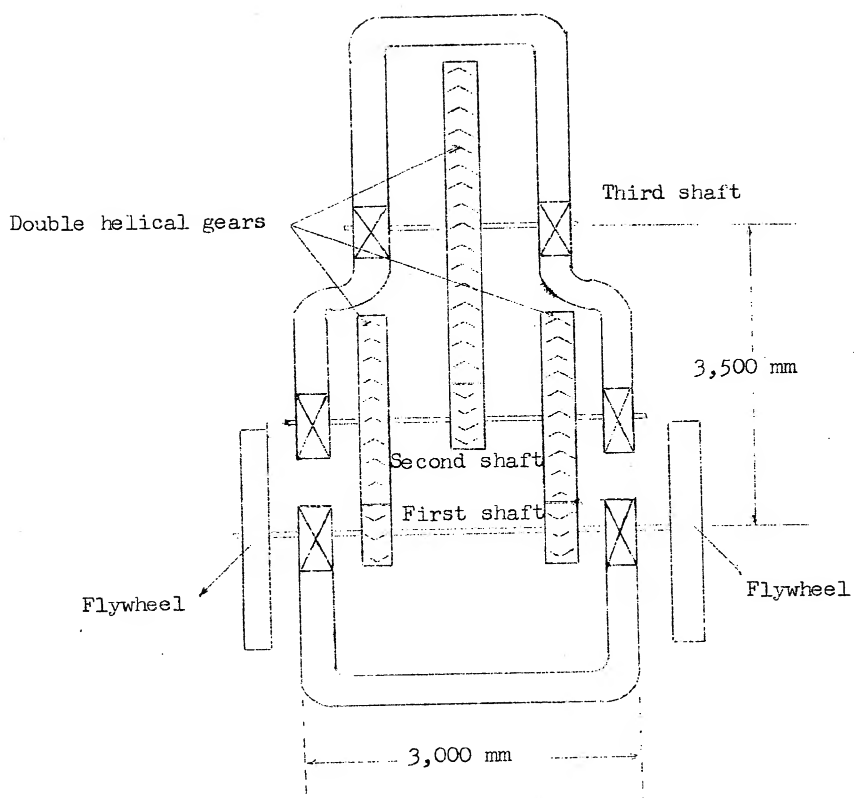
Doc No 90225 (10) (PB)

Chart No 10-57

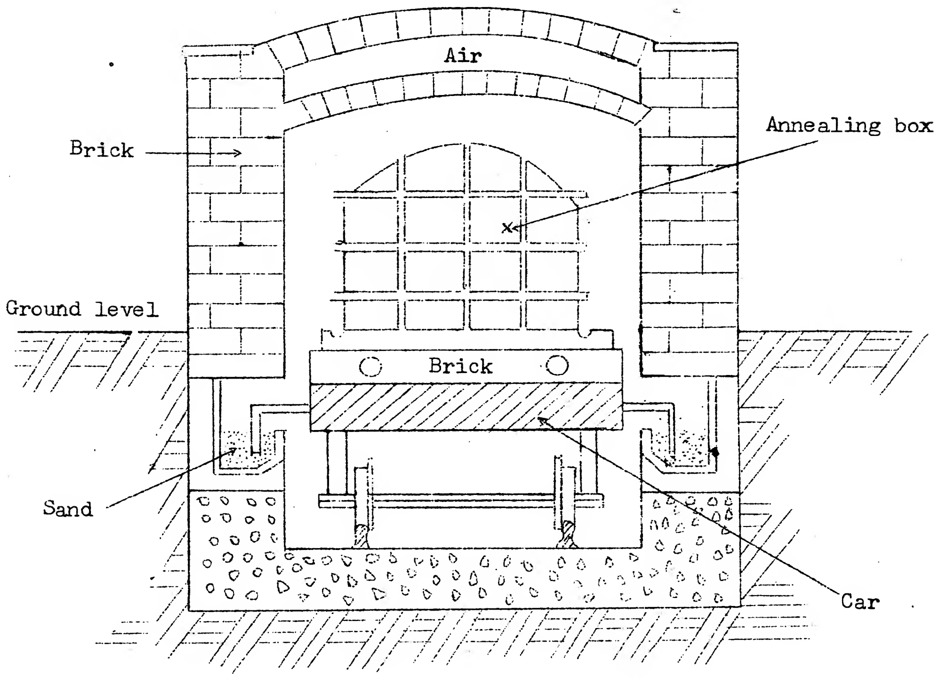
Sheet Roll Three-stage Reduction Gear



Doc No 90225 (10) (PB)
Chart 10-58

Structure of the Sheet Mill's Continuous Annealing Furnace
(End of the first quarter of 1953)

(Cross-section of furnace)



(Cross-section of annealing box)

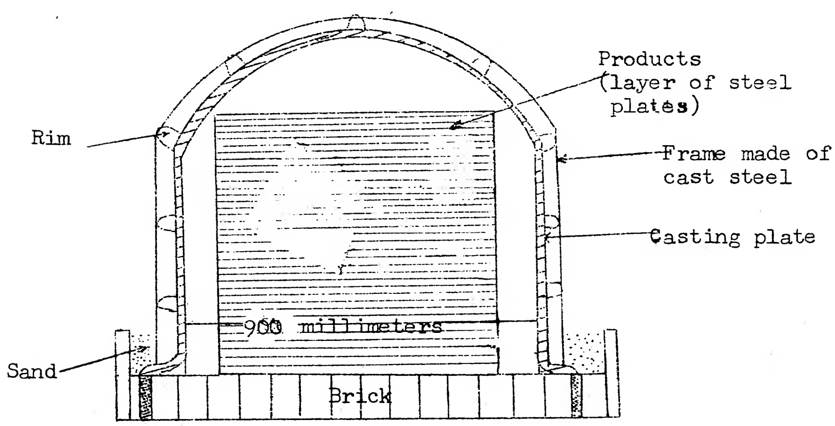


Chart No 10-59

Sheet Rolling Operation at the T'ai-yuan Iron and Steel Works
(End of the first quarter of 1953)

1. Rolling operation of sheet less than 1.0 millimeter in thickness

(Sheet bar) → (1) Shearing (shearing machine) → (2) Heating (crude furnace) → (3) Primary roughing roll (roughing mill) → (4) Heating (foil sheet furnace) → (5) Secondary roughing roll (roughing mill) → (6) Finishing roll (finishing mill) → (7) Shearing and separation (shearing machine) → (8) Roughing straightening (cold roll) → (9) Annealing (annealing furnace) → (10) Finishing straightening (multiple-spindle, sheet straightener) → (11) Inspection → (Product)

2. Rolling operation of sheet less than 0.6 millimeter in thickness

(Sheet bar) → (1) Shearing (shearing machine) → (2) Heating (crude furnace) → (3) Primary roughing roll (roughing mill) → (4) Primary heating (foil sheet furnace) → (5) Secondary roughing roll (roughing mill) → (6) Doubling (doubling machine) → (7) Secondary heating (foil sheet furnace) → (8) Finishing roll (finishing mill) → (9) Shearing and separation (shearing machine) → (10) Roughing straightening (cold roll) → (11) Annealing (annealing furnace) → (12) Finishing straightening (multiple-spindle, sheet straightener) → (13) Inspection → (Product)

Doc No 90225 (10) (PB)

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Chart No 10-60

Sheet Roughing Roll Operation
(End of first quarter of 1953)

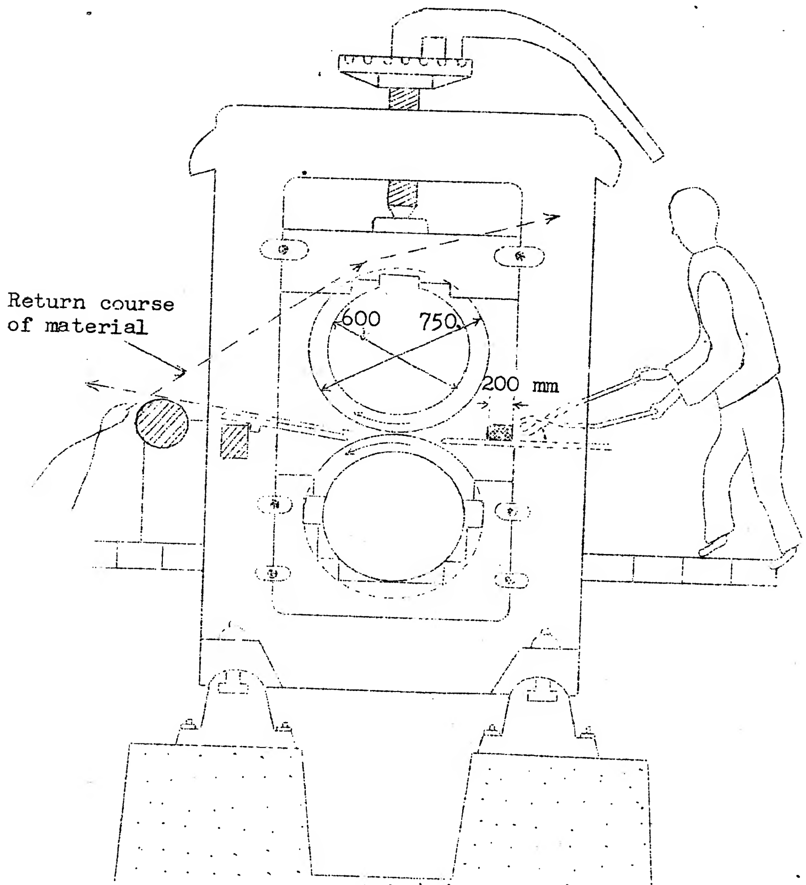

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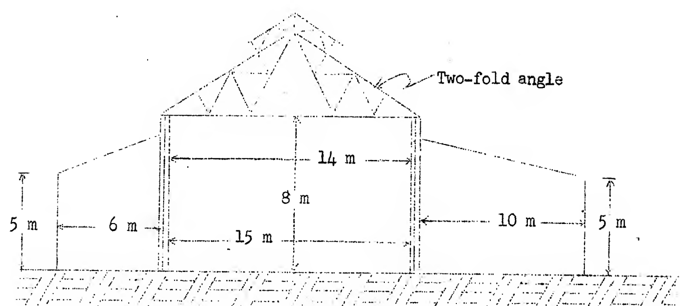
Chart No 10-61

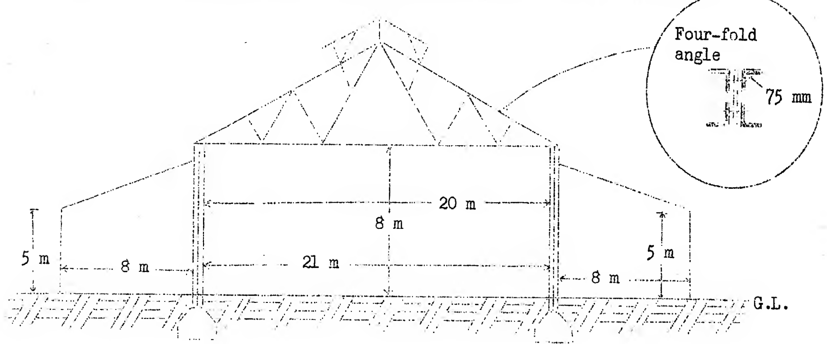
Cross Section of the Chilled Casting Plant Building

Plant No 1



Plant No 2

(Utilized by
electric repairing
department)



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Doc No 90225 (10) (PB)

Chart No 10-62

Essentials on the Riser in Chilled Roll Casting
(First quarterly period in 1953)

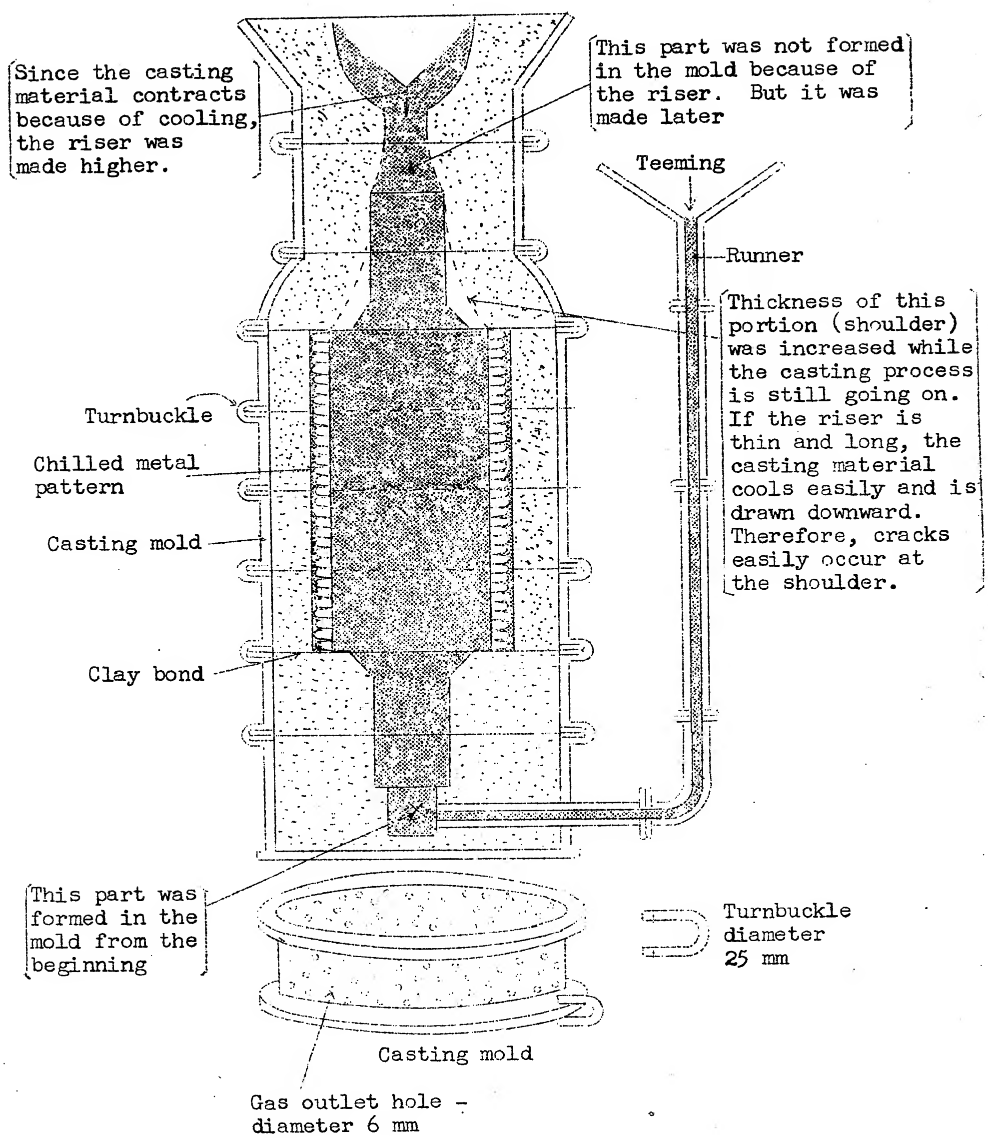
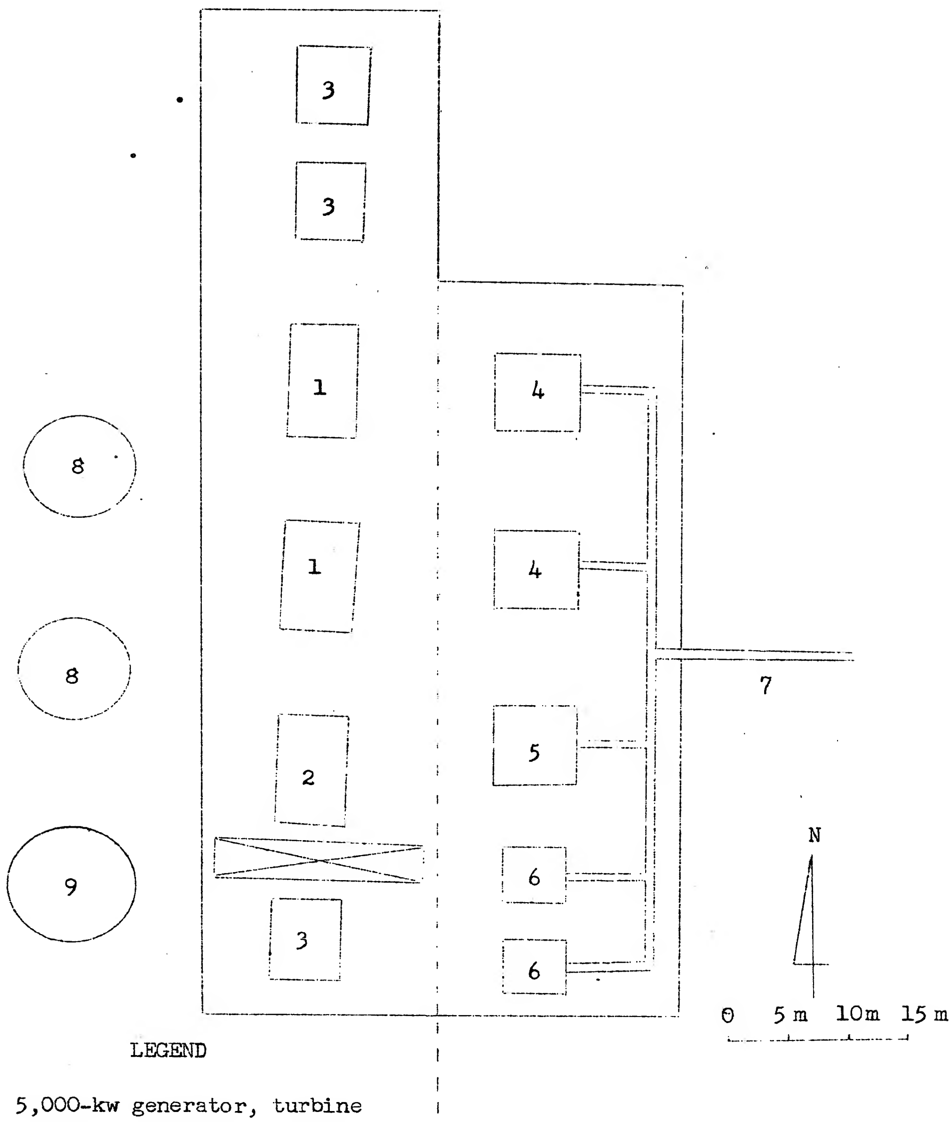


Chart No 10-63

Layout of Facilities of Power Plant No 3
(End of the first quarter of 1953)



LEGEND

1 5,000-kw generator, turbine
2 6,000-kw generator, turbine
3 Blower
4 GIRUJITSUSHU* Boiler
5 Babcock boiler
6 Small boiler
7 Blast furnace gas pipe
8 New cooling tower
9 Old cooling tower

Doc No 90225 (10) (PB)

Chart No 10-64

Water Intake and Water Supply Facilities
(End of the first quarter of 1953)

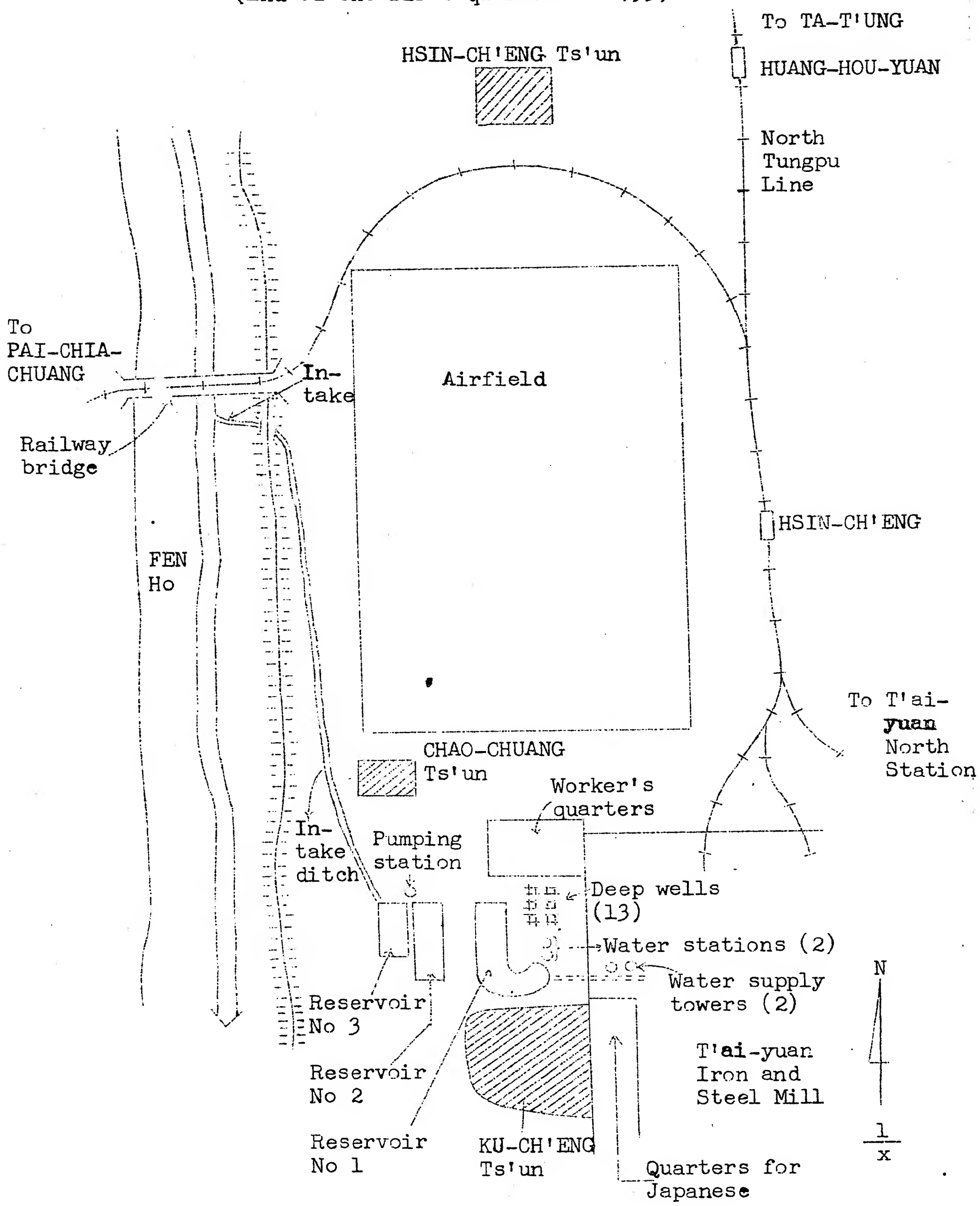


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Chart No 10-65

Organization of the Technical Supervision Section (End of the first quarter of 1953)

- Technical Supervision Section (Chief)
  - Combined Decision Group
  - Physical Testing Subsection
    - Physics Team
    - Metallographical Team
    - Heat Treatment Team
  - Chemical Testing Subsection
    - Organic Team
    - Iron and Steel Team
    - Coke Team
    - Special Steel Team

Note: Total number of personnel -- 200

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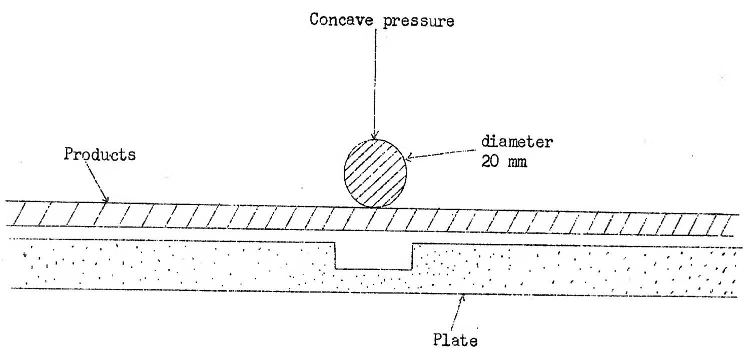
Chart No 10-66

Ericksen Cupping Test Procedure



Doc No 9-225 (10) (FB)

Chart No 10-67

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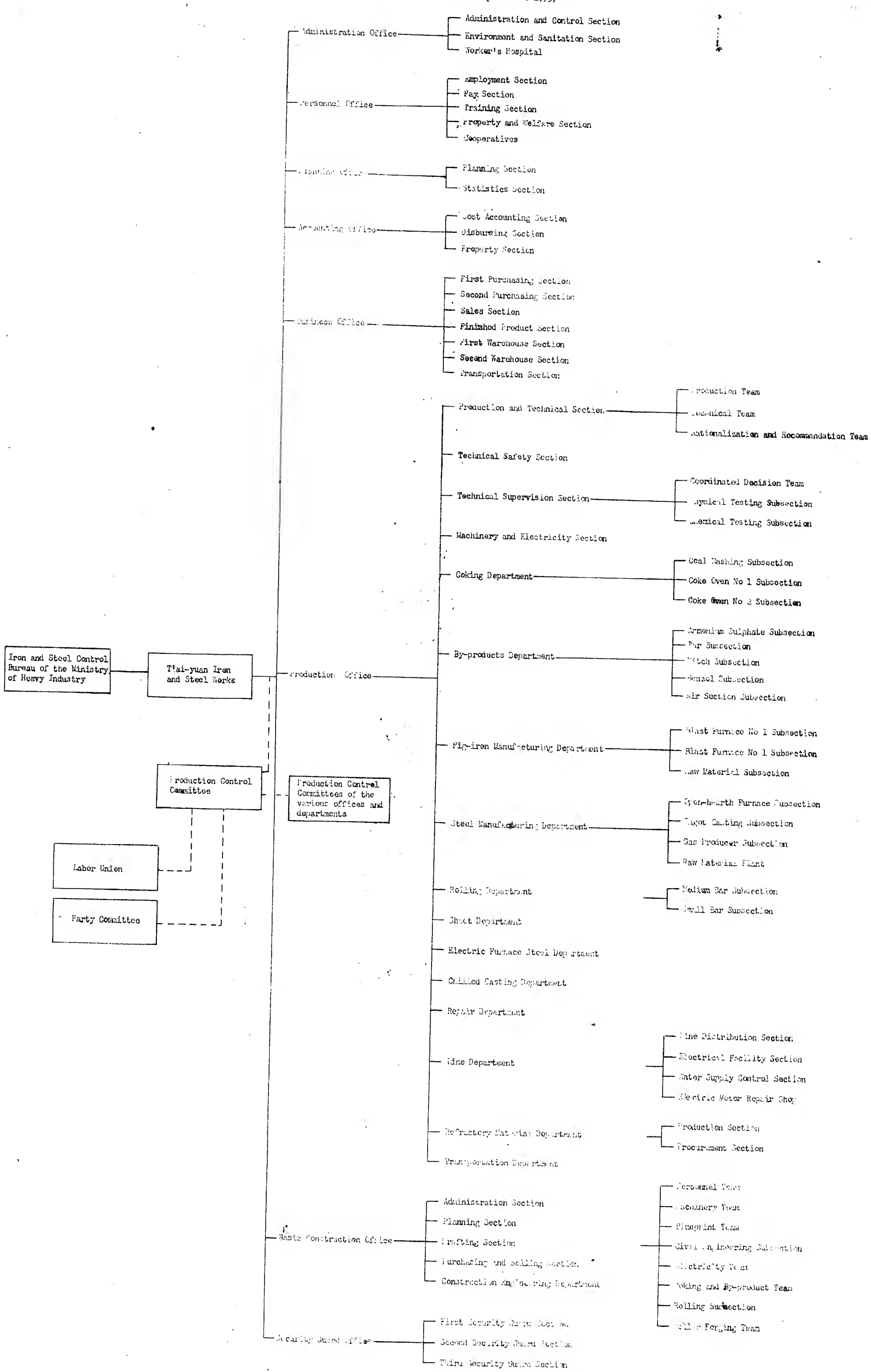
Management Structure of the T'ai-yuan Iron and Steel Works

(End of the first quarter of 1953)



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POOR ORIGINAL

Doc No 90225 (10) (PB)

Chart No 10-68

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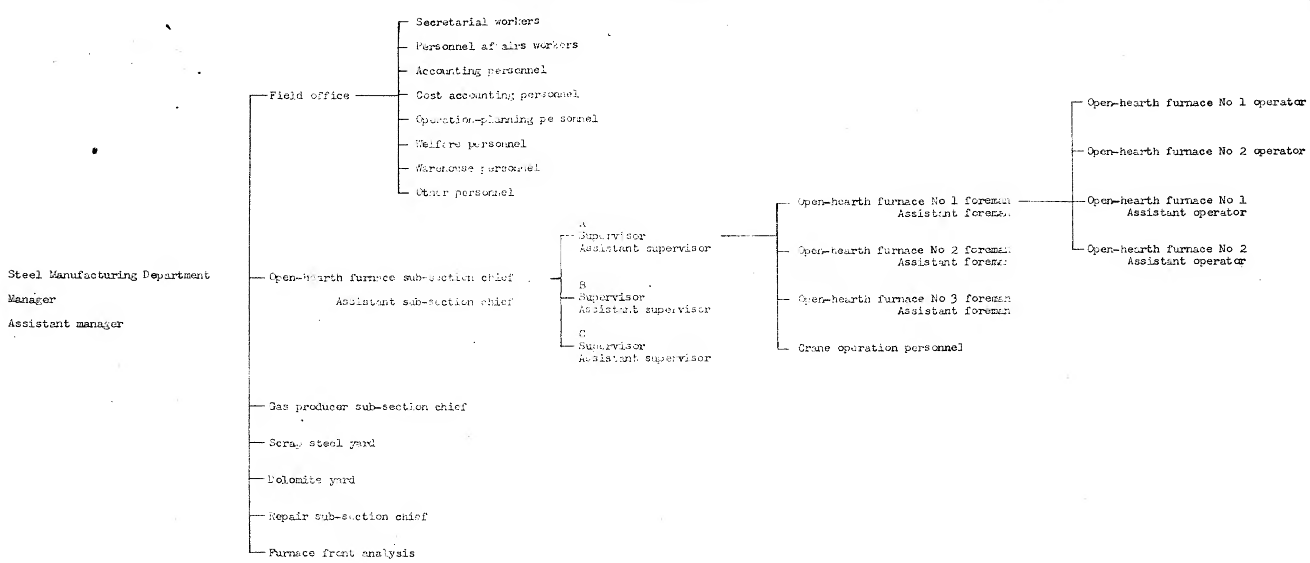
Operational Setup of the Steel Manufacturing Department



Note: A, B, and C refer to the three shifts.

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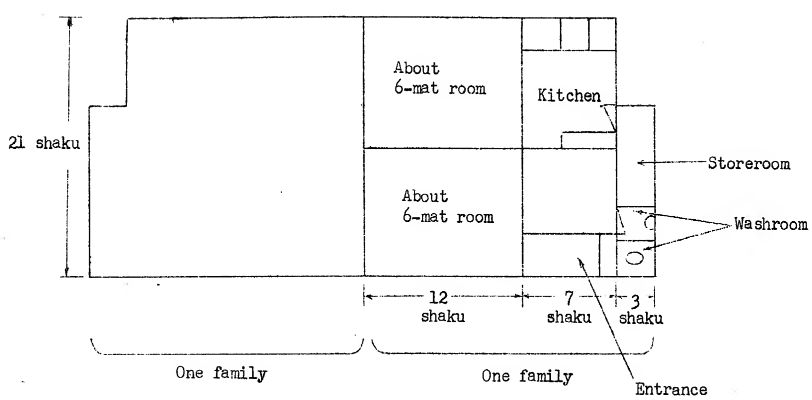
Chart No 10-69

Housing Plan at KU-CH'ENG-TS'UN
(Two-family unit)



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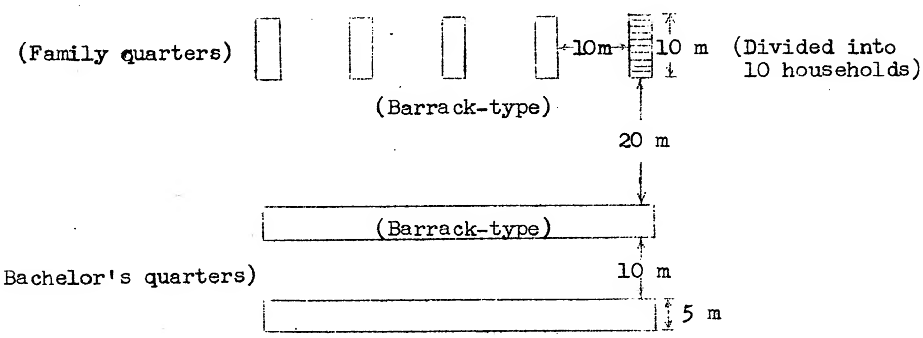
Doc No 90225 (10) (PB)

Chart No 10-70

Housing Facilities at SHIH-LI-P'U

Layout of quarters



Cross section of bachelor's quarters

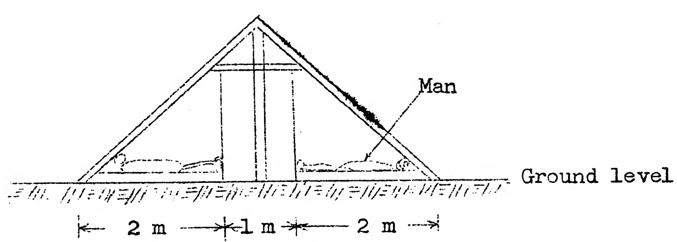


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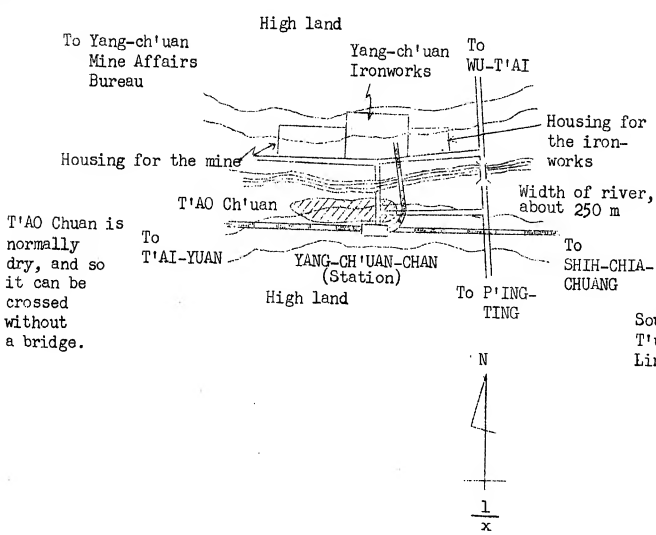
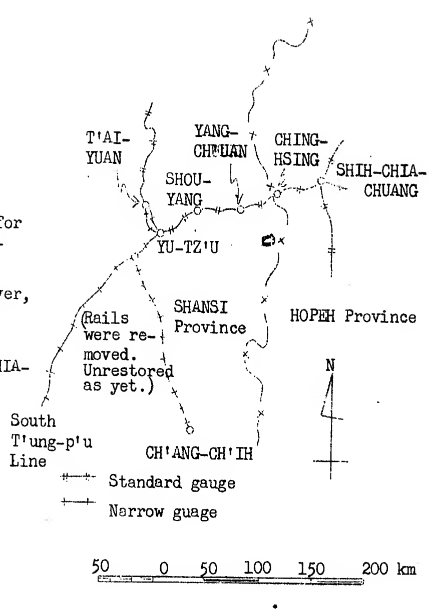
Chart No 10-71

Location of the Yang-ch'uan Ironworks





Doc No 90225 (10) (PB)

Chart No 10-72

Facilities Layout of the Yang-ch'uan Ironworks
(Summer 1950)

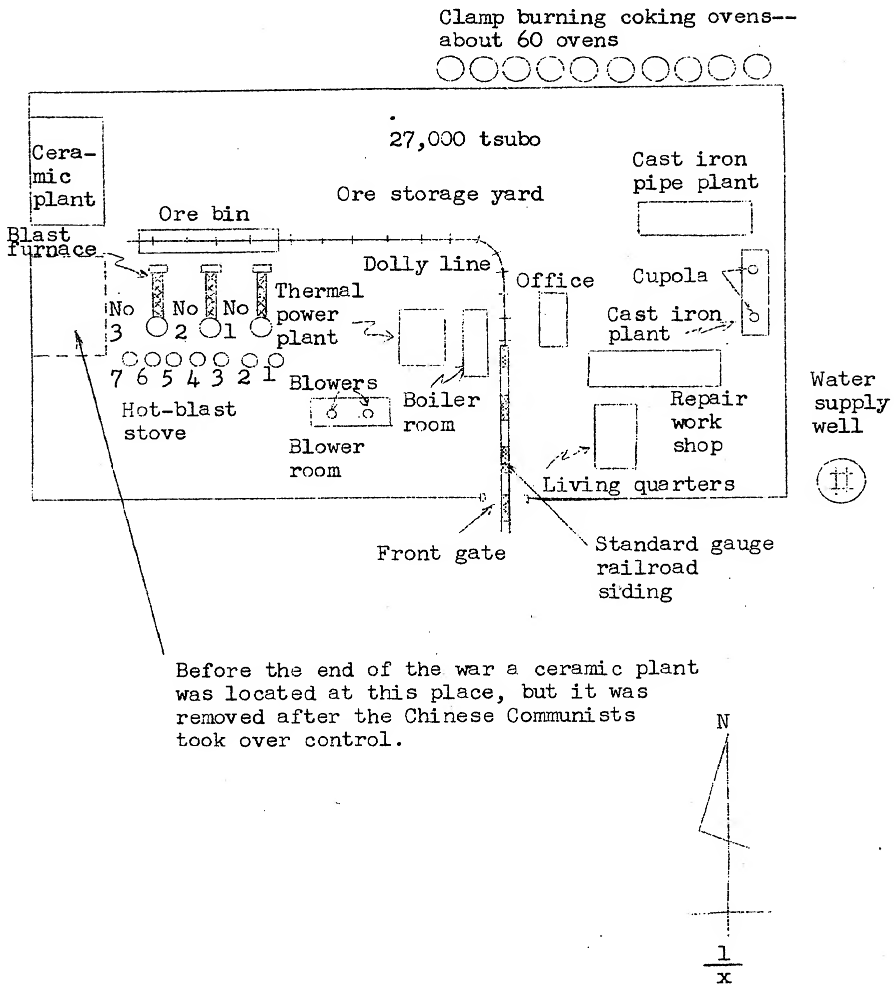


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Table No 10-1

Main Equipment of the T'ai-yuan Iron and Steel Works

Department	Name of equipment	End of war in 1945: Number	End of war in 1945: Efficiency and other data	Late 1953: Number	Late 1953: Efficiency and other data
Coke and by-products	Coke oven No 1	One unit	HINZERUMAN* combination type --- 30 ovens Amount charged in one oven --- 10 tons Actual productive capacity --- 241 tons a day	One unit	HINZERUMAN* combination --- 36 ovens Amount charged in one oven --- 11 tons Actual productive capacity --- 432 tons a day
	Coke oven No 2	-	-	One unit	HINZERUMAN* combination type --- 30 ovens Amount charged in one oven --- [illegible] tons Actual productive capacity --- 375 tons a day
	By-products: Ammonium sulphate extracting equipment	One set	Gypsum method Ammonium sulphate crystallization capacity --- 2 tons a day	One set	Gypsum method Ammonium sulphate crystallization capacity --- 2 tons a day
	By-products: Tar extracting equipment	One set	Processing capacity --- 30 tons a day	One set	Processing capacity --- 30 tons a day
	By-products: Benzol extracting equipment	One set	60 per cent benzol manufacturing capacity -- 2.5 tons a day	One set	60 per cent benzene manufacturing capacity - 2.5 tons a day
Pig-iron manufacturing	Blast furnace No 1	-	Rated capacity --- 40 tons a day Effective working volume of the furnace --- 58 m³ Original facility	1	Actual capacity --- 175 tons a day Effective working volume of the furnace --- 158 m³ Third facility
	Blast furnace No 2	1	Rated capacity --- 12[illegible] tons a day Effective working volume of the furnace -- (?) (TN Sic.) Original facility	1	Actual capacity --- 29[illegible] tons a day Effective working volume of the furnace --- 29[illegible] m³ Third facility
	Blast furnaces No 3 and No 4	2	Rated capacity for each furnace --- 4[illegible] tons a day Destroyed in late 1944	-	-
Steel manufacturing	Open-hearth furnaces No 1 and No 2	2	Basic, Martin Rated capacity for each furnace --- 30 tons a charge	2	Basic, Martin Rated capacity for each furnace --- 5[illegible] tons a charge Effective area of the hearth --- 26 m²
	Open-hearth furnace No 3	-	-	1	Basic, Martin Rated capacity --- 50 tons a charge Effective area of hearth --- 26 m²
	Electric furnaces No 1 and No 2	-	-	2	Hercult Rated capacity --- 3 tons a charge Transformer volume No 1 --- 1,[illegible] kva No 2 --- [illegible],[illegible]00 kva
	Electric furnaces No 3 and No 4	-	-	2	Heroult Rated capacity --- 8 tons a charge Transformer volume of each furnace --- [illegible],500 kva
Rolling	Medium bar mill	One set	Number of stand -- [illegible] ZAKSE* made roll -- three-high Motor (Used jointly with small bar mill) 1,500 hp Rated capacity --- 150 tons a day (steel stock) --- 45,[illegible] tons a year	One set	Number of stand --- 3 ZAKRU* made roll --- three-high Motor (exclusive use) --- 1,500 hp Actual capacity Billet --- 500 tons a day Steel stock --- 264 tons a day
	Small bar mill	One set	Number of stand: Rough --- [illegible] Finishing --- 7 Roll: Rough --- three-high Finishing --- two-high Motor: (none) (Used jointly with medium bar mill) Rated capacity (steel stock) --- [illegible] tons a day	One set	Number of stand: Rough --- [illegible] Finishing --- 7 Roll: Rough --- three-high Finishing --- two-high Motor: Rough --- [illegible] hp Finishing --- 1,500 hp Actual capacity (steel stock) --- [illegible] tons a day
	Sheet mill	-	-	Two sets	Two-high pullover Number of stand --- 6 Rated capacity --- 2,000 tons a year
Casting	Reverberatory furnace	-	-	-	Rated capacity --- 15 tons a charge
Forging	Hammer	-	-	4 - 5	Capacity --- unknown Power --- steam and electricity
Refractory material facility		One plant	Actual capacity --- 10,0[illegible] tons a year	One plant	Actual capacity --- 30,000 tons a year

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Table No 10-2

Raw Material Situation of the T'ai-yuan Iron and Steel Works

Name of item	Producing center	Composition	Means of transportation and distance	Required amount in 1953	Summary
Coal	FU-CHIA-T'AN	Superior coking	Railroad - About 200 km	216,000 tons	There were five boiler rooms. Bony coal obtained after the coal washing process was used as the principal fuel
	HSI-SHAN	Semi-coking	Railroad - About 20 km	264,000 tons	
	TA-T'UNG	Producer gas	Railroad - 357 km	Open-hearth use 40,000 tons Rolling use 10,000 tons	Thirty tons of coal were burned each day for the medium bar and sheet rolling mills
	Total			(530,000 tons)	
Iron ore	LUNG-YEN (P'ANG-CHIA-PU)	Iron 55 per cent	Railroad - About 590 km	147,000 tons	Tung-shan ore is not mentioned in the plan. However, with the use of this ore, probably the amount of ore purchased from outside the province will decrease to some extent
	WU-AN (HOPEH Province)	Iron 58 per cent	Railroad - About 440 km	74,000 tons	
	LI-KUO (KIANGSU Province)	Iron 59 per cent	Railroad - About 817 km	43,000 tons	
	TUNG-SHAN	Iron 40 - 47 per cent	Wagon - About 20 km	20,000 - 30,000 tons④	
	Total			(264,000 tons) Excluding figure indicated with ④	
Limestone	HSI-SHAN	C_aO is over 50 per cent	Railroad - About 20 km	For manufacturing pig iron ------- 121,000 tons	Probably owing to the iron ore content, 800 kg was charged to produce one ton of pig iron
	TUNG-SHAN	SiO_2 is below one per cent	Wagon - About 20 km	For manufacturing steel ------- 9,000 tons	
	Total			(130,000 tons)	
Manganese ore	LO-P'ING (KIANGSI Province)	Manganese 32 - 35 per cent	Railroad	For manufacturing pig iron ------ 5,000 tons For manufacturing steel ------- 1,300 tons	
	Total			(6,000 - 7,000 tons)	
Refractory material (dolomite, silica, clay)	HSI-SHAN	Good quality	About 20 km	30,000 - 40,000 tons	
	TUNG-SHAN		About 20 km		
	Total			(30,000 - 40,000 tons)	
Steel scrap	SHANSI Province		Railroad	Open-hearth use 35,000 tons	
	Ching-ching area			Electric furnace use 9,000 tons	
	Shanghai area				
	Total			(44,000 tons) (Including the scraps in the iron works)	
Grand total		—		1,004,000 - 1,015,000 tons	

Note: 1. This table was compiled mainly on the basis of raw materials purchased from the outside.

2. In addition to the coking raw material used exclusively by the iron works, the amount of demand for coal includes the coking raw material purchased from the outside (80,000 to 90,000 tons).

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Table No 10-3 Itemized Output of Products

Department	Item	Output during the peak year before the end of war (unit: ton)	Output for 1952 (unit: ton)	Output for 1953 (Planned) (unit: ton)
Coke and by-products	Lump coke	1942 ------------- 82,530	194,280	290,000
	Tar	" ------------- 4,300	6,700	Unknown
	Ammonium sulphate	" ------------- 300	230	"
	Crude benzol	" ------------- 620	1,680	"
	Pitch	" ------------- 2,530	2,990	"
	Creosote	" ------------- 900	1,100	"
	Crude naphthalene	" ------------- 230	256	"
	Crude anthracene	" ------------- 78	100	"
Pig iron	Pig iron	" ------------- 44,201	over 130,000 30% of this amount consisted of pig for casting	151,250 Of which about 30% were pig for casting
Steel	Open-hearth steel	" ------------- 36,000	91,200	130,000 (In spring 1953 statistic revised to 114,280)
	Electric furnace steel	" -	Some	Structural steel 8,100
Rolling	Medium bar mill	" about 30,000	Unknown	Steel stock 6,000 Billet 100,000 Sheet bar 19,000
	Small bar mill	1944 about 5,000	Unknown	Steel stock 54,000
	Sheet mill	-	-	Silicon steel plate 3,500 Ordinary steel plate 11,000
Casting		-	Chilled 610	Chilled 1,000 (?) (TN Sic.)

Table No. 10-4

Changes in Management of the T'ai-yuan Iron and Steel Works

Period	Name of Enterprise	Form of Enterprise	Affiliation	Managing Executives		Operational Conditions
				High ranking supervisor	Immediate supervisor	
Provincially operated era before the war (1935 to November 1937)	T'ai-yuan Steel Mill	Provincially operated	Northwest Industrial Company	General manager: P'ENG T'u-hung		Facilities under construction. Unoperated
Japanese Army controlled era (November 1937 to September 1942)	North China Army Shansi Iron Ore Works Plant No 6	Army control	North China Army (Administration entrusted to the Hsing-chung Company)	Board chairman: OTA Fumio	Plant superintendent: TAKAHASHI Tetsuzo	Construction completed. Commenced integrated process of steel manufacture (including mining)
Japanese operated era (October 1942 to August 1945)	T'ai-yuan Iron Works	Civil operation	Shansi Industrial Company Limited	First president: OTA Fumio Second president: KAWAMOTO Daisaku	Works superintendent: TAKAHASHI Tetsuzo	Continuation of integrated process of steel manufacturing. Newly constructed a small bar mill.
Provincially operated era after the end of war (August 1945 to April 1949)	T'ai-yuan Steel Mill	Provincially operated	Northwest Industrial Company	General manager: P'ENG T'u-hung	Mill superintendent: LIANG Hai-chiao	Continuation of integrated process of steel manufacturing.
North China Peoples' Government era (April to September 1949)	T'ai-yuan Steel Mill	Public operation	North China Iron and Steel Company of the Public Enterprise Department	Chief of the confiscation and custody group: LAI Chi-fa	Army representative: CHANG Pei-hung	Same as above.
After the establishment of the Central Peoples' Government (after October 1949)	T'ai-yuan Iron and Steel Works	State operated	Iron and Steel Control Bureau of the Ministry of Heavy Industry	Head of the Control Bureau	First superintendent: LI Fei-ping Second superintendent: PAI Hao	Same as above. Constructed the following new plants: Sheet mill Electric furnace plant Forging shop (Not engaged in mining)

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Table No 13-8

Structure and Capacity of Coke Oven No 2
(End of the first quarter of 1953)

Name	Number	Details	Structure	[illegible]
Number of oven battery	1			
Number of ovens	30			
Type			HIN[illegible] combination-type Regenerative oven	Similar to the Otto-type
Rated capacity		Daily carbonization amount of each oven --- 6.7 tons Total of daily carbonization amount ----- 201.0 "		
Nominal charging amount		Daily amount of each oven ------------ 10.0 tons Daily total - ------------------------ 300.0 "	Actual charging amount ------------ 11 tons	
Various departments of the oven body	Omitted (same as coke oven No 1)			
Coal tower	1	Capacity --------------------------- 600 tons	Established between coke ovens No 1 and No 2. There are two feeding chutes with four feeding ports on each chute. Coal can be fed to the four coal bins on the charging car.	Ground leveling began during the Japanese controlled era. Foundation concrete was poured during the Chinese Nationalist era. Construction during the Chinese Communist era began with the pillars and was completed in 1951.
Charging car running above the oven	1	Capacity ------------------------ 10 tons Lateral speed ------------------- 60 m/min Motor --------------------------- 35 hp	The charging car runs laterally above coke oven No 2. The charging car has four coal bins.	
Coke guide	1	Lateral speed ------------------- 20 m/min Motor --------------------------- 15 hp Furnace lid removing motor ------ 5 hp		
Quenching car puller	1	Since there was no electric train (Spring 1953), a small steam locomotive was used temporarily to pull the quenching car		
Quenching car	1	Capacity ------------------------ 15 tons Width --------------------------- 2,500 mm Length -------------------------- 8,000 "	Made of steel	
Quenching tower	1	Width --------------------------- 5,000 mm Length -------------------------- 11,000 " Height -------------------------- 25,000 "	Three-story concrete structure	Completed in summer 1952.
Water circulating apparatus for quenching	Motor - 2	Motor --------------------------- 35 hp Revolution ---------------------- [illegible],800 rpm Water circulation volume -------- 3.4 m^3/min	Diameter of pipe ------------ 6 inches Head ------------------------ 25 meters	
	Settling pond - 2	4,000 m x 6,000 mm x 1,500 mm		
Coke wharf	1 set	Width --------------------------- 5,300 mm Length -- ------------------------ 28,000 "		
Belt conveyer running underneath the coke wharf	1 set	Width --------------------------- 600 mm Length -------------------------- 30,000 " Transit volume ------------------ 40 tons/hr		Width is expected to be widened to 750 mm in the future.
Belt conveyer running to the coke sieving plant	1 set	Width --------------------------- 600 mm Length -------------------------- 102,000 " Transit volume ------------------ 40 tons/hr		Same as above
Coke crusher	1			
Coke siever	1	Motor --------------------------- 15 hp	A freight car is able to move in directly underneath the roller screen	
Belt conveyer running to the coke storage bin	1 set	Width --------------------------- 600 mm Length -------------------------- 10,000 " Transit volume ------------------ 40 tons/hr		
Coke storage bin	2	6,000 mm x 6,000 mm x 5,000 mm	Reinforced concrete structure; it is a surface facility; a freight car is able to move in underneath the storage bin	Completed in autumn 1952.
Manufacturer				Communist CHINA
Date of construction				Fired in September 1952

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Table No 10-9

Composition of Washed Coal

Item		Moist %	Ash %	Volatile %	Fixed carbon %	Yield %
Raw coal	Before the end of 1951	4 - 5	20 - 25	22 - 24	50 - 55	-
	After the end of 1951	4 - 5	17 - 18	25 - 26	52 - 56	-
Washed coal	Before the end of 1951	10	15	25 - 26	56 - 58	40
	After the end of 1951	10	12 - 13	26 - 27	58 - 60	45
Washed coal slurry	Before the end of 1951	20 - 23	14	25 - 26	57 - 58	40
	After the end of 1951	20 - 23	10 - 11	26 - 28	60 - 62	40

Note: The above-mentioned coal is all from LU-CHIA-T'AN.
Results of technical analysis are unknown.

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Table No 10-10

Coke Production by Mechanical Ovens

Fiscal year	Amount of ore coal used (ton)	Washed coal		Amount charged (ton)	Lump coke		Number of ovens	Amount charged to one oven (ton)	Remarks	
		Amount of washed coal (ton)	Ratio to ore coal		Output (ton)	Ratio to the amount charged				
1940	72,000	57,000	80	54,750	36,400	66.5	5,500	10	Japanese era	Production commenced in July
1941	140,000	112,000	80	109,500	72,800	66.5	10,950	10		
1942	160,000	128,000	80	124,100	82,530	66.5	12,410	10		
1943	148,000	118,400	80	116,800	77,680	66.5	11,680	10		
1944	130,000	104,000	80	109,500	72,800	66.5	10,950	10		A certain amount of unwashed coal was charged
1945	90,800	72,640	80	75,600	50,270	66.5	7,560	10		Same as above
1946	130,000	104,000	80	102,200	67,960	66.5	10,220	10	Chinese Nationalist era	
1947	140,000	112,000	80	109,500	72,800	66.5	10,950	10		
1948	130,000	104,000	80	102,200	67,960	66.5	10,220	10		
1949	85,000	68,000	80	66,600	44,300	66.5	6,660	10		
1950	166,000	132,800	80	131,400	87,380	66.5	13,140	10	Chinese Communist era	
1951	216,000	172,800	80	170,600	11[illegible],300	66.5	16,250	10.5		
1952	310,000	264,000	85	Oven No 1 200,750	Oven No 1 150,560	75.0	Oven No 1 18,250	11.0		Operation of coke oven No 2 was commenced in September
				Oven No 2 63,360	Oven No 2 43,720	69.0	Oven No 2 5,760	11.0		
1953 (Plan)	482,000	410,000	85	Oven No 1 214,434	Oven No 1 159,726	75.0	Oven No 1 19,494	11.0		
				Oven No 2 191,136	Oven No 2 1[illegible]1,884	69.0	Oven No 2 17,376	11.0		

Note: 1. All the figures on this table are approximate figures. However, there is no great difference.

2. In addition to lump coke, there is about five to eight per cent of coke breeze. However, it is not included in this table.

3. Coal slurry is included in the amount of washed coal.

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Table No 10-11

Composition and Physical Strength of Coke Produced at the T'ai-yuan Iron and Steel Works

Part 1. Composition of Coke

Period	Moist (%)	Ash (%)	Volatile matter (%)	Fixed carbon (%)	Total (%)	Porosity (%)	Remarks
1940 - 1949	8 - 13	15 - 22	2	72 - 80	100	40 - 50	When unwashed coal was used the ash content once reached as high as 27 per cent.
1949 - 1953	5 - 6	10 - 16	2	80 - 90	100	40 - 50	After 1953, the ash content is kept less than 13 per cent.

Part 2. Sieve Tests of Coke (Chinese Communist Era)

Testing method	Physical strength				
	More than 50 mm	38 - 50 mm	25 - 38 mm	13 - 25 mm	Less than 13 mm
Shutter test (Drop test)	About 50% Integration 50%	About 15% Integration 65%	About 20% Integration 85%	About 9% Integration 94%	About 6% Integration 100%
Drum test (Rotating test)	About 40% Integration 40%	About 20% Integration 60%	About 24% Integration 84%	About 8% Integration 92%	About 8% Integration 100%

Note: 1. In the shutter test, 25 kilograms of test coke is placed in a steel testing box, which is 710 mm long, 455 mm wide, and 380 mm deep, and dropped from the position, two meters high. Test coke is sieved with specified sieves, weighed according to sizes, and shown in percentages. In general, it is shown in integrating figures.

2. In the drum test, about 10 kilograms of test coke are placed in a drum and rotated for two minutes at the speed of 15 rpm. Test coke is sieved, weighed according to sizes, and shown in percentage. The drum is made of steel and measures 1,500 mm in inside diameter, 1,500 mm in length and 6 mm in thickness. It is rotated horizontally. In the drum, six blades (250 mm in width and over six mm in thickness) are installed vertically at equal intervals.

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Table No 10-12

Facilities in the Suction Plant of the Coking Department

(End of the first quarter of 1953)

Nomenclature		Equipment of coke oven No 1: Number of equipment	Equipment of coke oven No 1: Data	Equipment of coke oven No 1: Structure	Equipment of coke oven No 1: Others	Equipment of coke oven No 2: Number of equipment	Equipment of coke oven No 2: Data	Equipment of coke oven No 2: Improvement
Uptake pipe		One set	Diameter: 380 mm Diameter of damper: 80 mm	It is made of cast iron and installed on the top of the oven on the coke pusher side. The lower part is connected to the dry main. There is a damper, lined with fire bricks, inside the pipe.		One set	Same as coke oven No 1	Owing to its convertion into the Otto system, settling of tar slags was prevented by spraying liquid-ammonia, and water was shut out by rotating the damper.
Dry main		One set	Diameter: 1,600 mm	It is installed on the coke pusher side. The uptake is connected to the upper portion of this main and one end is connected to the liquid-ammonia pipe and another end to the suction main. A seal pot is installed at each joint. Thus enabling extraction of tar slags.		One set	Same as coke oven No 1	
Liquid-ammonia pipe		One set	Diameter: 125 mm	It connects the dry main and the settling tank.		One set	Same as coke oven No 1	
Suction main		One set	Diameter: 600 mm	It connects the dry main and gas coolers.		One set	Same as coke oven No 1	
Gas cooler		Four	Data of each cooler 1. Height 6,500 mm 2. Length 5,000 mm 3. Diameter of steel gas pipe 2.5 inches 4. The entire cooling volume 1,200 m^2	Three coolers are installed at the front and one at the rear of the gas exhauster. The interior of the iron shell of a cooler is divided into numerous water compartmente and a steel gas pipe is installed in each compartment. The gas and water pass in opposite directions. Liquid-ammonia and tar outlets are installed at the bottom of the gas flue.		Four	Data of each cooler 1. Diameter: 2,300 mm 2. Height: 6,300 mm 3. Diameter of steel gas pipe: 3 inches	To increase the cooling volume, the 2.5-inch gas pipe was replaced by a three-inch pipe.
Gas exhauster	No 1	One	1. Motor: 41 hp, 3,600 rpm 2. Single-stage turbine: 5,300 rpm 3. Air volume: 107 m^3/min 4. Intake pressure: 100 mm on the water column 5. Exhaust pressure: 200 mm on the water column		Following Chinese Communist control, the motor was replaced by a 150 hp motor because it was unable to supply gas to the rolling mill.	Two	1. Motor: 250 hp 1,000 rpm 2. Air volume: 150 m^3/min 3. Intake pressure: 1,000 mm on the water column 4. Six-stage turbo-exhauster	An unused motor, which was brought from PEN-CH'I during the Japanese era, was installed. As the result, the output remarkably increased.
	No 2	One	Steam turbine Data on others are the same as for gas exhauster No 1					
Cooling water circulating pump	No 1	One	1. Motor: 15 hp 2. Turbine pump: 1,750 rpm 3. Water supply volume: 2.1 m^3/min 4. Head: 20 m			Two	1. Motor: 25 hp 1,800 rpm 2. Water supply volume: 2.4 m^3/min 3. Head: 15 m 4. Pipe diameter of the centrifugal pump: 6 inches	Water supply volume was increased by 10 per cent by increasing the horse-power of motors.
	No 2	One	Steam turbine Data on others are the same as for cooling water circulating pump No 1.					
	No 3	One	Motor: 25 hp Data on others are the same as for pump No 1		Additionally installed in 1950.			
Liquid-ammonia recovery facilities	Liquid-ammonia circulating pump	Three	1. Motor: 35 hp, 1,750 rpm 2. Water supply volume: 2.4 m^3/min 3. Head: 20 m 4. Centrifugal pump			Two	1. Motor: 35 hp 1,800 rpm 2. Water supply volume: 3.4 m^3/min 3. Head: 20 m 4. Centrifugal pump diameter: 5 inches	
	Settling tank (separation tank)	One	Diameter: 1,500 mm Length: 3,500 mm			Two	Model and characteristice are the same as for coke oven No 1	
		One	Diameter: 2,000 mm Length: 8,000 mm					
	Tar tank	One	Diameter: 2,000 mm Length: 8,000 mm			One	Model and characteristice are the same as for coke oven No 1	
	Liquid-ammonia tank	One	Square (TN Sic.): 2,000 mm Length: 8,000 mm			One	Model and characteristics are the same as for coke oven No 1	
Tar extractor		Two	Diameter: 1,300 mm Height: 4,000 mm	The interior of the extractor is divided into three steps and filled with RASHITSUHI* ring (inglazed ring), and thereby tar content is extracted by a pressure method. A tar extractor is installed in the front as well as in the rear of the gas exhauster.	Following the Chinese Communist control, a tar extractor was additionally installed and the number of tar extractors became two.	Two	Diameter: 2,300 mm Height: 4,500 mm	Following the Chinese Communist control, a tar extractor was additionally installed. The volume of this new extractor was remarkably increased.
Ammonia scrubber		Three	Diameter: 2,300 mm Height: 17,000 mm	While clear water is sprinkled down, the gas is passed upwards and thereby scrubbed. More than 10 wooden shelves are installed within the scrubber and contact of water and gas is increased.	These scrubbers extract ammonia content in the gas.	Three	Diameter: 2,300 mm Height: 17,000 mm	
Liquid-ammonia pump		Five	Rotary pump 1. Number of revolutions: 150 rpm 2. Liquid-ammonia supply capacity: 10 ton/hour	Operated by one 25-hp motor	Circulation pumps for the ammonia scrubber and pumps used for running ammonia to the ammonium sulphate plant.	Five	1. Motor: 7.5 hp 1,800 rpm 2. Liquid-ammonia supply volume: 0.45 m^3/min 3. Head: 30 m 4. Turbine pump diameter: 2 inches	Liquid-ammonia supply volume was remarkably increased
Tar pump		Three	Rotary pump 1. Number of revolutions: 75 rpm 2. Tar supply capacity: 2 tons/hr			Three	Rotary pump 1. Diameter: 2 inches 2. Revolutions: 125 rpm 3. Supply capacity: 5 tons/hour	Tar supply volume was remarkably increased.
Benzol scrubber		Three	Diameter: 2,300 mm Height: 21,000 mm	The structure is the same as that of the ammonia scrubber. Gas is drawn in from the bottom and creosote oil is sprayed from the top.	These scrubbers recover benzol content in the gas.	Three	Diameter: 2,300 mm Height: 21,000 mm	
Creosote oil pump and tank	Pumps used for circulation (recovery) and transfer of oil	Five	Turbine pump 1. Number of revolutione: 1,700 rpm 2. Oil supply volume: 12 - 15 m^3/hr		When this mill was taken over by the Chinese Communists, five rotary pumps (one five-hp, three 7.5-hp, and one 15-hp pumps) were installed as in the case of ammonia pumps. However, because of inefficiency, these pumpe were replaced by three-stage to five-stage turbine pumps (spare pumps).	Four	Turbine pump 1. Number of revolutions: 270 rpm 2. Oil supply volume: 17 tons/hour 3. Diameter: 2.5 inches	
	Tanks used for circulation (recovery)	Two	Diameter: 2,000 mm Length: 8,000 mm			Two	Model and characteristics are the same as for coke oven No 1.	

Note: Commencement of operations

1. Facilities for coke oven No 1, July 1940

2. Facilities for coke oven No 2, September 1952

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Table No 10-13

Facilities at the Ammonium Sulphate Plant of the Coking Department
(End of the first quarter of 1953)

(Operational method ------------------------- Gypsum method)
(Commencement of operation ------------------- August 1940)
(Crystal ammonium sulphate output capacity --- Two tons a day)

Nomenclature	Number	Output capacity	Data and structure
Lime kiln	2	5 tons/day	Bottle-shape equipped with material elevators
Carbon dioxide purification apparatus	1 set		
Carbon dioxide compressor	1		30 hp
Ammonia still	2 sets	10 m3/hour Ammonia content five per cent	Feldman still
Recirculation cooler	2 sets		
Reactor	2		Equipped with agitators
Vacuum filter	1		
Preheater	1		
Vacuum still	1		
Ammonia sulphate (salt) collector	1		
Centrifugal separator	1		
Elevated tank	1 set		
Condenser	1 set		
Vacuum pump	2		15 hp
Blower	1		2 hp
Auxiliary tank	1 set		
Liquid ammonia tank	1		Diameter: 2,000 mm Length : 8,000 mm
Ammonium sulphate mother liquid tank	1		Diameter: 2,000 mm Length : 6,000 mm
Lime slurry agitator	1		Removed and not in use after the Chinese Communist control
Gypsum pulverizer	1	2 tons/hour	30 hp
Remarks	The liquid ammonia tank is the same as the one listed under the suction plant.		

Table No 10-14

Facilities at the Tar Plant of the Coking Department
(End of the first quarter of 1953)
(Commencement of operation --- August 1940)
(Processing capacity --------- 30 tons/day)

Nomenclature	Number	Output capacity	Data and auxiliary facilities	Nomenclature	Number	Output capacity	Data and auxiliary facilities
Intermittent-type still	2	Distillation 30 tons/day	Volume 20 tons Total 40 tons	Crystallization tank	8		Volume, 3 tons
Heat exchanger	2		Hose-type	Centrifugal separator	1		
Cooler	2		Hose-type	Filter press	1	200 kg/hr	
Light oil separator	1		Diameter: 1,200 mm Length: 5,000 mm	Rotary pump	2	5 tons/hr	
Oil receiver	4		Diameter: 1,200 mm Height: 1,500 mm	Washington pump	1	2 tons/hr	
Pitch cooler	2		Diameter: 2,500 mm Height: 4,000 mm		2		Diameter: 2,000 mm Height: 8,000 mm
Pitch gas cooler	1		Diameter: 1,000 mm Height: 2,500 mm	Tank	1		Diameter: 1,500 mm Height: 3,000 mm
Pitch bay	1 set (4)		Volume 25 tons		3		Diameter: 4,000 mm Height: 5,000 mm

Table No 10-15

Facilities at the Benzol Plant of the Coking Department
(End of the first quarter of 1953)
(Output capacity --------------- 2.5 tons/day
Commencement of operation ---- September 1940)

Nomenclature	Number	Data and auxiliary facilities	Nomenclature	Number	Data and auxiliary facilities
Light oil still (Column still)	1		Purification still (Column still)	1	
Dephlegmeter and separator	1		Cooler	1	
Preheater	2		Scrubbing facilities	1 set	Equipped with an acid-alkali tank.
Heat exchanger	2		Tank	5	Diameter: 2,000 mm 6,000 mm
Oil cooler	4			1	Diameter: 1,500 mm 3,000 mm
Semi-processing still	1	Filled with RASHITSU HI RINGU* Volume: 8 tons		1	Diameter: 1,000 mm 2,500 mm
				1	Diameter: 2,000 mm 4,500 mm
Cooler	1		Oil-supply pump		Centrifugal-type 3 hp

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Table No 10-16

Output of By-products

Year	Tar (tons)	Ammonium sulphate (tons)	Crude benzol (tons)	Tar distilled amount (tons)	Creosote (tons)	Pitch (tons)	Crude napthalene (tons)	Crude anthracene (tons)
1940	2,100	150	220	1,900	430	1,230	110	36
1941	3,800	240	450	3,400	790	2,210	200	68
1942	4,300	300	620	3,900	900	2,530	230	78
1943	3,700	250	580	3,300	770	2,140	200	66
1944	3,500	200	430	3,000	700	1,950	180	60
1945	2,400	150	260	1,900	430	1,230	110	36
1946	2,800	200	400	2,500	590	1,620	150	50
1947	3,000	200	430	2,700	620	1,760	160	54
1948	2,800	200	400	2,500	590	1,620	150	50
1949	1,800	150	260	1,600	380	1,040	100	33
1950	3,600	350	650	3,300	760	2,140	190	66
1951	4,600	400	900	3,600	850	2,300	220	73
1952	6,700	230	Crude 1,300 Motor 380	5,700	1,100	Soft 790 Hard 2,200	Crude 196 Industrial 60	100

Remarks

1. All figures, with the exception of those for 1952, are estimated approximate values.
2. The 1952 column indicates actual figures. In addition, 16 tons of carbolic acid, 52 tons of solvent oil, 100 tons of anhydrous coal tar, and 2,800 tons of quicklime were produced in 1952. The manufacturing of carbolic acid began sometime in 1952.

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Table No 10-17

[illegible]
([illegible] quarter [illegible])

Classification	[illegible]			[illegible]		Blast [illegible] No 2 [illegible]	[illegible] No 4 (Sm. 1)
Type of furnace	[illegible]			[illegible]		[illegible]	[illegible] type
Total capacity	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Effective working volume	68 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] me 1/ [illegible]	[illegible] meters)
Date blown in	[illegible]	Spring [illegible]	[illegible]	[illegible] 10	[illegible]	[illegible]	[illegible]
Date blown out	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
Country offering construction technique	G[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Construction [illegible]	[illegible]			[illegible]		[illegible]	[illegible] 13. [illegible] 1.? [illegible]
Structural outline: Type of [illegible]	[illegible]			[illegible]		[illegible]	[illegible]
Structural outline: [illegible]	[illegible]			[illegible]			
Structural outline: [illegible]	[illegible]			[illegible]			
Structural outline: Furnace [illegible]	[illegible]			[illegible]			
Structural outline: [illegible]	[illegible]			[illegible]			
Structural outline: Hearth	[illegible]			[illegible] type			
Structural outline: Gas blow-off	[illegible]			[illegible]			
Structural outline: Dust catcher	[illegible]			[illegible] type — [illegible]			
Structural outline: [illegible] main	[illegible]			[illegible] in [illegible]			

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Table No 10-18

Hoisting Apparatus For Blast Furnace
(End of the first quarter of 1953)

Classification	Blast furnace No 1	Blast furnace No 2	Blast Furnace No 3 and No 4	Remarks
Type	Bucket	Skip		Double -drum type
Capacity	60 horsepowers Alternating current, 3,300 volts	60 horsepowers Alternating current, 3,300 volts	Details unknown	Electric apparatus
Hoisting speed	About 80 meters per minute	About 80 meters per minute		
Rope diameter	Two 6-inch ropes	One 12-inch rope		
Control apparatus	Magnetic brake	Magnetic brake		

Table No 10-19

Hot-blast Stoves
(End of the first quarter of 1953)

Classification	For blast furnace No 1	For blast furnace No 2	For blast furnaces No 3 and No 4	Remarks
Number of stoves	Three	Four	Three each	Normally, three to each blast furnace
Type	Cowper	Cowper	Cowper	Two-pass type
Diameter and height	Diameter 5,000 mm Height 25,000 mm	Diameter 6,000 mm Height 27,500 mm		Out of four hot-blast furnaces attached to blast furnace No 2, one of them had a diameter of 5,000 mm and stood 25,000 mm high.
Combustion method	Blast system	Blast system		
Heating area	Detail unknown	About 5,000 square meters	Detail unknown	
Regenerating area	Detail unknown	7,000 square meters		
Grate hole layer	Single	Single		
Size of grate hole	100 x 100 mm	120 mm x 120 mm		Grate brick is 60 mm in thickness.
Amount of gas used	About 20 per cent of blast-furnace gas			
Construction period	During Japanese control (Date unknown)		October 1943	

Table No 10-20

Blowers for Blast Furnace
(End of the first quarter of 1953)

Classification	Blower No 1	Blower No 2	Blower No 3	Blower No 4
Type	Electric turboblower	Electric turboblower	Electric turboblower	Steam turbine
Horsepower	500	600	800	1,500
Air volume (cubic meters per minute)	400	500	600	Detail unknown
Air pressure (pounds per square inch)	6	7	8	15
Number of revolutions (rpm)	3,600	3,600	3,600	2,800
Construction period	November 1939	November 1939	November 1940	Just before the end of the war, this second-hand equipment was installed
Usage	Was in reserve at the end of the war	At the end of the war, it was attached to No 1 blast furnace	At the end of the war, it was attached to No 2 blast furnace	
	Currently, in reserve	Currently in reserve	After the second half of 1951, it was attached to blast furnace No 1.	After the second half of 1951, it was attached to blast furnace No 2.

Note: Blower No 4 is an old second-hand equipment which was in use just before the end of the war. It was brought in from AN-SHAN, but it was not in full operation.

The condition of the blower which was used in the small blast-furnace in 1944 is unknown.

Table No 10-21

The T'ai-yuan Iron and Steel Works' Purchasing Plan of Iron Ore from Other Provinces for 1953

Producing area	Type of ore	Quality (per cent)	Ore ratio	Tonnage (tons)	Means of transportation	Transporting distance (kilometers)	Remarks
LUNG-YEN	Hematite	55		147,000	Railroad	About 590	Via the North T'ungp'u Line
WU-AN	Magnatite	58		74,000	Railroad	About 440	
LI-KUO	Magnatite	59		43,000	Railroad	About 817	Via the Shihte Line
Total			1.76	264,000			

Note: In addition, instruction was received from the Central Government to use a very small amount of ore mined in the province. .

Table No 10-22

Amount of Raw Materials Charged into the Blast Furnaces (End of the first quarter of 1952)

Classification	Amount charged at one time					Number of charges daily
	Coke	Iron ore	Limestone	Manganese	Total	
Blast furnace No 1	1 ton	1.4 to 1.5 tons Coke ratio, 140 to 150 per cent	0.45 ton Ore ratio, about 30 per cent	30 to 40 kilo-grams The amount differs each day	2.9 to 3.0 tons	Seven to eight times an hour. About 180 times a day.
Blast furnace No 2	2 tons	2.8 to 3.0 tons Coke ratio, 140 to 150 per cent	0.6 ton Ore ratio, about 30 per cent	80 kilograms The amount differs each day	5.4 to 5.6 tons	Seven to eight times an hour. About 180 times a day.

Note: 1. The amount of pig-iron output at that time was as follows:

a. Blast furnace No 1 -- 160 tons a day (average)

b. Blast furnace No 2 -- 270 tons a day (average)

2. Fluorite was not used.

3. Hematite from P'ANG-CHIA-P'U (LUNG-YEN) was mainly used as iron ore.

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Table No 10-23

Variations in the Daily Output of Pig Iron (Unit: ton)

Period / Blast furnace	Autumn 1949 to Spring 1950	Late 1950	Late 1951	Late 1952	Spring 1953	Remarks
Blast furnace No 1	40	120	140	170	175	Rated capacity 40 tons
Blast furnace No 2	120	200	240	280	290	Rated capacity 120 tons
Total	160	320	380	450	465	
Remarks	The daily output on this table indicates the average output of pig iron (including rejected pig iron).					

Note: Refer to paragraphs under improvement of facilities for the sharp increase in daily output.

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Table No 10-24

Variations in the Annual Output of Pig Iron (Unit: ton)

Year	Blast furnace No 1	Blast furnace No 2	Blast furnaces No 3 and No 4	Total	Remarks
1939	3,322	-	-	3,322	Initial firing of blast furnace No 1 -- November 1939
1940	17,022		-	17,022	Initial firing of blast furnace No 2 -- November 1940
1941	35,582		-	35,582	
1942	44,201		-	44,201	
1943	29,940		2,790	32,730	Initial firing of blast furnaces No 3 and No 4 -- September 1943
1944	10,907		2,373	13,280	Blast furnaces No 3 and No 4 were abandoned after being bombed in late 1944
1945	-	950	-	950	Results of April to August 1945
1950	70,000 - 75,000		-	70,000 - 75,000	
1951	About 100,000		-	About 100,000	
1952	More than 130,000		-	More than 130,000	
1953 (Planned)	62,800	88,450	-	151,250	Major repairs on blast furnace No 2 after being blown out
Remarks	1. The output prior to the year 1945 is based on the Japanese fiscal year. Thereafter, calendar year. 2. The amount indicates accepted pig iron.				

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Table No 10-25

Floor Space of the Buildings of the Steel Manufacturing Department

Installation	Floor space of buildings			Remarks
	Before Chinese Communist took control	After Chinese Communist took control	End of first quarter of 1953	
Open-hearth furnace plant	One building 4,212 square meters (width - 36 meters) (length - 117 meters)	Building enlarged by 2,808 square meters (width - 36 meters) (length - 78 meters)	One building 7,020 square meters	1. Under construction in Spring 1953. 2. There were plans for constructing a mixer plant (36 by 39 meters).
Gas producer plant	One building 396 square meters (width - 8 meters) (length - 49.5 meters)	One building added 180 square meters (width - 10 meters) (length - 18 meters)	Two buildings 396 square meters 180 square meters	The newly constructed building was a two-story building.
Dolomite plant	One building 150 square meters (width - 10 meters) (length - 15 meters)	Same as left	Same as left	
Woodwork shop	One building 60 square meters (width - 6 meters) (length - 10 meters)	Same as left	Same as left	

Table No 10-25 (Cont'd)

Installation	Floor space of buildings			Remarks
	Before Chinese Communist took control	After Chinese Communist took control	End of first quarter of 1953	
Miscel-laneous warehouse	One building 90 square meters (width - 8 meters) (TN Sic.) (length - 15 meters)	Same as left	Same as left	
Dressing room	One building 80 square meters (width - 8 meters) (length - 10 meters)	Same as left	Same as left	
Steel manufac-turing office	One building 90 square meters (width - 8 meters) (TN Sic.) (length - 15 meters)	Same as left	Same as left	In Spring 1953, a new office building was being constructed on the north side of the open-hearth furnace plant to make room for the projected mixer plant.
Assay room	One building 60 square meters (width - 6 meters) (length - 10 meters)	Same as left	Same as left	For the same reason as above, a new assay office was under construction in Spring.1953

Table No 10-26

Data on the Open-hearth Furnace Facilities

Item		Data	Remarks
Classification		Basic	
Type		Martin, stationary	
Fuel used		Fired exclusively by producer gas, coke gas is also used	Since there is a shortage of coke gas supply, hardly any is actually used
Rated capacity		50 tons	When constructed in 1941, both open-hearth furnaces No 1 and No 2 had a rated capacity of 30 tons. After the war ended, they were enlarged to 40-ton capacities. They were reenlarged in spring 1952 to a capacity of 50 tons. Open-hearth furnace No 3 was newly built in September 1952 and it had a rated capacity of 50 tons
Actual capacity			Restricted by the ladle crane; was less than 40 tons in spring 1953
Dates of construction		Furnaces No 1 and No 2 were constructed in July 1941, No 3 in September 1952	
Charge volume		55 tons	Actual charge in spring 1953 was 40 tons
Hearth	Length of hearth (molten steel surface) (L)	9,000 millimeters	
	Width of hearth (molten steel surface) (B)	3,600 millimeters	
	L/B	2.5	2.2 under Japanese and Chinese Nationalist control
	Area of hearth (L x B)	32.40 square meters	
	Depth	450 millimeters	Measured from the hearth to the molten steel surface
Roof	Height	1,950 to 2,000 millimeters	
	Rise	400 millimeters	
Back wall slope angle		55 degrees	
Front wall slope angle		Perpendicular	
Length of combustion chamber		1,100 to 1,[illegible] millimeters	
Type of port		Voll	Formerly Ruppmann type, but was changed in spring 1952
Gas port	Number	One	
	Height	750 millimeters	
	Width	700 millimeters	
Air port	Number	Two	
	Roof's slope angle	40 degrees	25 degrees during Japanese and Chinese Nationalist control. The Chinese Communists first changed it to 30 degrees and later to 40 degrees
Gas slag pocket	Length	3,300 millimeters	
	Width	Unknown	The total width of this and the air slag pocket is 4,500 mm. However, this includes the thickness of the wall parting the two pockets
	From the top of the parting wall to the roof	1,200 millimeters	
Air slag pocket	Length	3,200 millimeters	
	Width	Unknown	The total width of this and the gas slag pocket is 4,500 mm. However, this includes the thickness of the wall parting the two pockets
	From the top of the parting wall to the roof	1,300	
Gas regenerator	Type	Horizontal type	
	Length	8,000 millimeters	
	Width	1,400 millimeters	
	Height	5,800 millimeters	
	Volume	65 cubic meters	The ratio of the volume of the gas chamber and the air chamber is 4 to 6
	Weight of the checkerwork brick	About 32 tons	About 80 tons of bricks are used in the gas and air regenerators. 80 tons x 4/10 = 32 tons
	Heating area of checkerwork	About 600 square meters	The heating area of the checkerwork for both the gas and air regenerators is about 1,500 square meters $1,500\ m^2 \times 4/10 = 600\ m^2$
	Size of the checkerwork brick	Length - 300 millimeters Width - 150 millimeters Thickness - 80 millimeters	However, the sizes of the bricks on the bottom 3 or 4 layers are: length 450 mm, width 400 mm, and thickness 150 mm
	Type of checkerwork and size of openings	Cylindrical type Top layers - 150 x 150 millimeters Middle layers - 200 x 200 millimeters Bottom layers - 2[illegible]0 x 2[illegible]0 millimeters	
	Volume of checkerwork	About 42 cubic meters	65 per cent of the volume of the regenerator
Air regenerator	Type	Horizontal type	
	Length	8,000 millimeters	
	Width	[illegible],100 millimeters	
	Height	[illegible] millimeters	
	Volume	100 cubic meters	
	Weight of checkerwork brick	About 48 tons	About [illegible] tons of bricks are used for both the gas and air regenerators About [illegible] tons x 6/10 = 48 tons
	Heating area of the checkerwork	About [illegible] square meters	The heating area of checkerwork for both the gas and air regenerators is about 1,500 square meters, $1,500\ m^2 \times 6/10 = 900\ m^2$
	Size of the checkerwork brick	Length - [illegible] millimeters Width - 150 millimeters Thickness - 80 millimeters	
	Type of checkerwork and size of openings	Cylindrical type Top layers - 150 x 150 millimeters Middle layers - [illegible] x 200 millimeters Bottom layers - [illegible] millimeters	
	Volume of checkerwork	65 cubic meters	65 per cent of the volume of the regenerator
Type of gas reversing valve		Butterfly type	Remodeled in spring 1952
Type of air reversing valve		Butterfly type	Remodeled in spring 195[illegible]
Smokestack	Height (above ground)	74 meters	
	Diameter at top	1,500 millimeters	

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Table No 10-27

Refractory Materials for the Open-hearth Furnaces
(End of the first quarter of 1953)

Place used	Refractory material used	Remarks
Bottom of furnace	Chamotte brick (bottom layer, one layer only) Chrome brick (4 layers Outer side, red brick	Insulation bricks are not used
Hearth	Magnesium stamped dolomite clinkers	
Front and back walls	Metal case (Inside filled with magnesium clinkers)	Size 120 x 120 x 400 to 500 cubic millimeters
Bottom port	Unknown	
Roof	Silica brick	
Regenerator checkerwork	Chamotte brick (bottom layers of brick, 3 or 4 layers) Silica brick	Size of the checkerwork brick 80 x 150 x 300 cubic millimeters

Table No 10-28

Gas Producers for the Open-hearth Furnaces
(End of the first quarter of 1953)

Number of furnaces			Data							Blowers		Usage
End of the war	Chinese Nationalist control	Today	Type	Inner diameter	Depth	Revolutions	Coal burning capacity	Country where manufactured	Time of manufacture	Number	Motor	
Five	Five	Five	Morgan	2,500 mm	About 4,000 mm	60 rpm	1949: 6 to 8 tons a day 1952: 13 tons a day	JAPAN	July 1941	One	One 50-hp motor	Used for open-hearth furnaces No 1 and No 2
-	One	One	Morgan	2,500 mm	About 4,000 mm	60 rpm	1949: 6 to 8 tons a day 1952: 13 tons a day	Nationalist CHINA	1947			
-	-	Two; new	Wood	3,000 mm	About 6,000 mm	60 rpm	30 tons a day	Communist CHINA	Sept 1952	One	One 30-hp motor	Used for open-hearth furnace No 3
Five	Six	Eight										

Notes: 1. Old and new buildings and the main pipes are independent of each other.

2. A detained Japanese technician drew up the plans for the two new Wood-type gas producers which were installed after the Chinese Communists took control. Since he did not have time to plan things out, he copied the blue prints (left behind when the war ended) of the gas producers located at SHIH-CHING-SHAN.

3. In the Morgan-type gas producers, the coal feeding, ash removal, and poker are all mechanically operated.

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Table No 10-29

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Accessories for Open-hearth Steel Manufacture
(End of the first quarter of 1953)

Name of plant	Equipment		Number	Data	Remarks
Raw materials yard	Scrap steel shearing machine		One		
	Pile driver tower		One	Height: 10,000 mm Vertical plumb bob: one ton	Used in crushing scrap steel.
	Raw material transport crane		One	Overhead traveling crane Capacity: 10 tons	
	Dolomite firing furnaces		Two	Each has a capacity of 15 tons a day	Used to make dolomite clinkers
	Dolomite plant blower		One		
	Motors	Used on scrap steel shearing machine	One	20 hp	
		Used on pile driver tower	One	10 hp	
		Used on dolomite plant blower	One	10 hp	
Open-hearth furnace plant	Hoist		One		For hoisting dollies
	Charging box		Many	Capacity of 2.5 tons	Used for charging raw materials
	Charging crane		Two	Overhead traveling crane Capacity: 5 tons	
	Winch used to open and close the charging doors on the open-hearth furnaces		Three		Before, they had been operated by hand but after the Chinese Communists took control, this operation was done by mechanical power.
	Air compressor		One	Capacity unknown	Used to blast compressed air into the open-hearth furnaces
	※Ladle car		Two		※Belong to the transportation department.
	※Hot-metal ladle		Two	Capacity: 25 tons Weight: 7 tons	※Belong to the pig-iron manufacturing department.
	Air hammer		One	Rated capacity -- ½ ton	Used in assaying
	Motors	Used on dolly hoist	One	10 hp	
		Used on the open-hearth charging door winches	Three	5 hp	
		Used on air compressors	One	10 hp	
		Used on air hammer	One	25 hp	
Ingot casting plant	Ladle crane		One	Overhead traveling, capacity 50 tons 5-ton auxiliary crane attached German ZATSUKU* make. The revolving part is all ball bearings.	In spring 1953, molten steel was limited to 33.5 tons a heat since the ladle crane was old.
	Ladle		Six	Capacity: 40 tons Weight: 10 tons	
	Ingot crane		Two	Overhead traveling, Capacity: 12 tons	Miscellaneous uses. Capacity said to be 10 tons
	Ladle pit		Three		Preheating use. Reported to be two of them.
	Casting pit		Four	Three (old facilities enlarged) width 4 meters; length 20 meters One (newly built in 1952) width 4 meters; length 20 meters Each has five plates	Some of these have facilities for use only in making castings, such as rollers. Size of the old pits: width 4 m x length 15m (The width is also said to be 3 m).
	Ingot cases		Many (72 for one heat)	Small type: 80-kg, 130-kg, 180-kg and 250-kg types Medium type: 680-kg, 800-kg and 1-ton types	680-kg cases are commonly used
Gas producer plant	Hoists		Two	Capacity: 2 tons	One each in the old and the new plant.
	Blowers		Two	Capacity: one 30-hp and one 50-hp	Old plant -- 50-hp New plant -- 30-hp
	Motors	Used on blower	One	50 hp	
		Used on blower	One	30 hp	
Others	Scale		One	Capacity: 70 tons	
	Assay equipment		One set		Used to make assays on the spot.
	Various gauges		One set		
Remarks	1. There are no mixers. 2. There are no soaking pits at the ingot casting plant. 3. The steam used in the gas producer plant is supplied by the boiler in the coking plant.				

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Table No 10-30

Improvement on Open-hearth Furnace Steel Manufacturing Equipment
(End of the first quarter of 1953)

Part improved		Improvement	Reason for improvement	Remarks
Ports	Type	The Ruppmann type was converted to the Moll type	To increase the heating power. (The Moll type was reported to be a Soviet type)	Supervised by Soviet technicians in Spring 1952
	Air port	Heretofore, the roof had sloped at an angle of 25 degrees. This was changed to 30 degrees after the Chinese Communists took over control. Later it was changed to 40 degrees.	To intensify force of flame striking the steel bath surface.	
	Gas port	The two old gas ports were converted into one.	To improve the air and gas mixture in the combustion chamber.	
Furnace body	Hearth	The length of the hearth which heretofore was 2.2 times the width, was increased to 2.5 times the width.	It was possible to lengthen the hearth because of longer flame.	
	Melting chamber	The depth was increased (450 mm to 480 mm). The height of the roof was increased (height from the steel bath line was changed to about 2,000 mm).	To increase the volume of molten steel. To increase the charge of scrap steel.	Increased height of the roof facilitates the charging of the bulky scrap steel and protects the roof brick, but necessarily lowers the thermal efficiency.
	Back wall	The slope of the wall was made greater. The degree of slope became 55 degrees.	To facilitate the adhesion of dolomite, etc. when making hot furnace repairs.	
Others	Slag chamber	The partition wall was made higher.	To prevent the flow of slag into the regenerator.	As there are yet no brick pillars (Soviet type) to free waste gas of its slag content.
	Regenerator	The checkerwork was remade into the cylindrical type	To facilitate cleaning	There is no great change in the thermal conductivity
	Reversing valves	The gas and air reversing valves were changed to the butterfly type.	To insure effective cutoffs.	

Table No 10-31

Increase in Open-hearth Steel Manufacturing Equipment
(End of the first quarter of 1953)

Classification	Equipment	Number	Type of project	Data	Period	Remarks
Actually completed	Open-hearth furnaces	Two	Conversion	Converted from 40 tons to 50 tons. Effective hearth area of 26 square meters.	Spring 1952	First phase basic construction (only the ladle crane incomplete)
		One	New construction	50-ton furnace with effective hearth area of 26 square meters	September 1952	
	Gas producers	Two	New construction	Burns 30 tons a day	September 1952	
	Molds		New construction	The commonly used steel ingots were increased from 500 kilograms to 680 kilograms		
Planned and proposed	Ladle crane	One	New construction	Capacity: 70 tons Exchange for the present 50-ton crane	Expected to be completed in 1953	Already ordered from the USSR. It was expected to arrive at the end of 1952, but it is being delayed.
	Open-hearth furnaces	Two	New construction	50-ton furnaces		Building was under construction in Spring 1953
	Gas producers	Four	New construction	30 tons a day		
	Mixer	One	New construction	Capacity, 300 tons		Originally (1951), the plans called for a capacity of 150 tons, but the plans were changed along with plans for five open-hearth furnaces
	Hoists	One set	New construction			It was necessary to newly construct a raw materials yard alongside the smokestack. This plan was under consideration since there was no room. It is highly probable that the plan will be carried out.

Not[illegible] An additional plan for [illegible] hearth fur[illegible]

Table No 10-32

Amount of Heat Maintained by Producer Gas
(End of first quarter of 1953)

Gas composition	Percentage contained in one cubic meter of gas	Amount of heat in one cubic meter of each component (kcal)	Amount of heat maintained by the various components in one cubic meter of gas (kcal)
Carbon monoxide	25 to 26	3,500	875 to 910
Methane	2.5 to 3.0	4,000	100 to 120
Hydrogen	15 to 16	2,500	375 to 400
Total	-	-	1,350 to 1,430

Note: This table contains only the principal components. If the calories of other components as CO_2, N_2, and C_2H_2 are included, the calories maintained in one cubic meter of producer gas would be 1,380 to 1,450 kilogram-calories.

Table No 10-33

Distribution of Producer Heat
(End of the first quarter of 1953)

Heat input and output section	Heat output rate (per cent)	Remarks
Molten steel (both)	25	Since the rate of combustion in the melting chamber of the open-hearth furnace is inadequate, the temperature in the regenerator reaches 1,450 degrees Centigrade and the heat loss is very great.
Regenerator	30	
Flue	5	
Smokestack	40	
Total	100	

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Table No 10-34

Distribution of Personnel in Open-hearth Furnace Steel [illegible]
(Limited to those known at the end of the first [illegible])

Place of duty		Number of personnel: Day time work	Day and night work: One shift	Day and night work: Three shifts	Total	[illegible]
Steel manufacturing office		40 to 5[illegible]			[illegible]	[illegible]
Open-hearth furnace and ingot casting plants	Office	[illegible]			[illegible]	[illegible]
	Open-hearth furnace plant		[illegible]			[illegible]
	Ingot casting yard		[illegible]	[illegible]	[illegible]	[illegible]
	Ingot steel scrap handling yard		[illegible]	[illegible]		
	Charging crane		[illegible]	[illegible]		[illegible]
	Ladle crane		[illegible]		[illegible]	[illegible]
	Sub-total	[illegible]		[illegible]	[illegible]	
Raw materials yard	Dolomite workshop		[illegible]			[illegible]
	Dolomite [illegible] line					
	Pile driver tower		[illegible]			
	[illegible] machines		[illegible]	[illegible]	[illegible]	
	Raw materials yard		[illegible]	[illegible]	[illegible]	[illegible]
	Charging [illegible] site			[illegible]	[illegible]	
	Raw materials crane			[illegible]	[illegible]	[illegible]
	Sub-total		[illegible]	[illegible]		
Gas producer plant	Office	[illegible]			[illegible]	
	Gas producer workshop		[illegible]	[illegible]	[illegible]	[illegible]
	New producer workshop		[illegible]	[illegible]	[illegible]	
	Connected with [illegible]		[illegible]		[illegible]	
	Coal transport [illegible] line		[illegible]	[illegible]	[illegible]	
	Sub-total	[illegible]	[illegible]	[illegible]		
Others	Measuring personnel		[illegible]	[illegible]	[illegible]	
	[illegible] personnel		[illegible]	[illegible]	[illegible]	
	[illegible] shop		[illegible]	[illegible]		
	Miscellaneous [illegible]		[illegible]	[illegible]		
	Repair shop	[illegible]			[illegible]	
	Sub-total	1[illegible]	12	36	[illegible]	
Total		[illegible] to 7[illegible]	1[illegible]0	[illegible]	[illegible]	

Notes
1. Workers connected with electrical [illegible] not shown.
2. [illegible] during Japanese [illegible]
   a. [illegible]-shift system with one open-hearth furnace in operation [illegible]
   b. Two-shift system with two open-hearth furnaces in operation [illegible]

Table No 10-35

Variation in the Mixing Ratio of Raw Materials for Open-hearth Steel Manufacture

Period		Steel manufacturing method	Name of material	Mixing ratio (per cent)	Remarks
Japanese control		Cold pig and scrap iron method	Cold pig	35	
			Scrap steel	65	
Chinese Nationalist control		Same as above	Cold pig	40	
			Scrap steel	60	
Chinese Communist control	1950 to 1951	Molten pig iron and iron ore method	Molten pig iron	90	There was a time when half-blast steel, manufactured by converters, was temporarily used as a substitute for steel scrap
			Scrap steel	10	
	After 1952		Molten pig iron	75	This mixing ratio was prescribed by the order of the Ministry of Heavy Industry in conformity with the National Pig-iron Supply and Demand Plan
			Scrap steel	25	

Table No 10-36

Amount of Charge in Open-hearth Steel Manufacture

Name	Amount of charge each time (tons)	Percentage against steel output (per cent)	Fe mixing ratio (per cent)	Remarks
Scrap steel	10.45	27.5	25.0	1. Steel output - 38 tons.
Ingot pig	30.40	80.0	75.0	2. The iron ore is produced in WU-AN and its iron content is 58 per cent.
Iron ore	About 2.00	About 5.0	-	
Limestone	About 2.50	About 7.0	-	3. Limestone includes quick-lime.
Manganese ore	About 0.50	About 1.0	-	
Total	About 45.85	About 120.5	100.0	

Table No 10-37

Charging Order of Raw Materials in Open-hearth Steel Manufacture

Period	Raw material	Amount of charge and mixing ratio	Remarks
Preliminary charge	Scrap steel	25 to 30 per cent	Ratio against the total charge of principal materials
	Limestone	1 to 1.8 tons	Flux; this is charged simultaneously with scrap steel
	Iron ore	2 tons	Oxidizing agent
	Manganese ore	0.5 tons	Oxidizing agent
After charge	Molten pig iron	70 to 75 per cent	Ratio against the total charge of principal materials. It is charged just before the scrap steel melts
	Quicklime	1 ton	Flux; this is charged within 10 or 15 minutes after the scrap steel melts during refining
	Fluorite	70 to 100 kilograms	Flux; this is charged depending on the condition of the slag when the melting of lime is insufficient
	Aluminum ferro-alloy	Very small amount	It is charged just prior to refining

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Table No 10-38

Supply and Demand Plan of Raw Materials for Open-hearth Steel Manufacture (1953)

Name	Amount of good ingot (accepted steel) (tons)	Steel output (tons)	Charging ratio against steel output (per cent)	Amount of charge (tons)	Remarks
Scrap steel			27.5	36,480	1. The figure for steel output was derived from the amount of good ingot and, rate of acceptance (99 per cent) and ingot recovery rate (99 per cent) 2. Description of ferroalloy and fluorite will be omitted
Molten pig iorn			80.0	106,120	
Iron ore			About 5.0	6,600	
Limestone			About 7.0	9,300	
Manganese ore			About 1.0	1,300	
Total	130,000	132,650	120.5	159,800	

Note: The amount of good ingot refers to the amount (production) of acceptable steel ingot.

Table No 10-39

Specifications for Carbon Steel Ingot (End of the first quarter of 1953)

Chemical composition

Symbol of product	Carbon	Silicon	Manganese	Sulphur	Phosphorus	Remarks
C - 0	Maximum 0.10	Maximum 0.05	0.30 to 0.50			
C - 1	0.10 to 0.15	Maximum 0.10				
C - 2	0.15 to 0.25	0.10 to 0.20	0.30 to 0.60			
C - 3	0.25 to 0.35			Maximum 0.050	Maximum 0.45	
C - 4	0.35 to 0.45	0.15 to 0.30	0.60 to 0.90			
C - 5	0.45 to 0.55					
C - 6	0.55 to 0.65					

Table No 10-39 (Cont'd)

Physical properties

Symbol of product	Mark	Steel quality	Tensile strength (kilogram per square millimeter)	Elongation (per cent)	Usage
C - 0	Indigo	Mildest steel	30 to 37	30 and above	Wire-drawing, pipe-making, sheet materials, structural materials, rivet, nails and others
C - 1		Very mild steel	34 to 40	25 and above	
C - 2	Yellow	Mild steel	37 to 45	22 and above	Nails, structural steel materials, steel tube materials, helix materials and others
C - 3	Red	Semi-mild steel	42 to 52	20 and above	
C - 4	White	Semi-hard steel	49 to 61	15 and above	Axles, tilted steel materials and others
C - 5	Green	Hard steel	58 to 65	12 and above	
C - 6	Red - white	Hardest steel	62 to 75	8 and above	Tilted steel materials, rails, crankshaft and others

Table No 10-40

Electric (Furnace) Steel Manufacturing Facilities
(End of the first quarter of 1953)

Name	Number	Type	Rated capacity	Data	Remarks
Electric furnace No 1	One	Basic, Heroult type, top charge furnace	One tapping, 3 tons	Capacity of transformer 1,050 kilovolt-ampere	This furnace (second-hand) was moved here from a certain place in autumn 1952.
Electric furnace No 2	One	Same as above	Same as above	Capacity of transformer 1,200 kilovolt-ampere	Same as above
Electric furnace No 3	(Incomplete) One	Same as above	One tapping, 8 tons	Capacity of transformer about 2,500 kilovolt-ampere	This furnace is being moved from T'ANG-SHAN. It is expected to be completed in 1953.
Electric furnace No 4	(Incomplete) One	Same as above	Same as above	Same as above	Same as above
Crane	Two	Overhead traveling	About 15 tons		One charging crane and one ingot crane
Ingot casting equipment	One set			Same as in the case of an open-hearth furnace	Pit, ladle, and ingot case.
Drying furnace	None				Incomplete
Annealing furnace	One	Unknown	Unknown		
Remarks	1. Facilities shown on this table are those which are known. 2. The 8-ton furnace and attached facilities had already arrived from T'ANG-SHAN. 3. Information on the equipment of the pattern plant is not clear.				

Table No 10-41

Production of Steel (crude steel) Manufactured by Electric Furnaces

Year	Number of furnace	Effective utilization coefficient (ton per 1,000 kilovolt-ampere a day)	Capacity of transformer (kilovolt-ampere)	Daily steel output (tons)	Rate of operation (per cent)	Annual steel output (tons)	Ingot recovery rate (per cent)	Percentage of accepted steel ingots (crude steel) (per cent)	Annual output of good ingot (crude steel) (tons)
Actual results of 1952	Electric furnace No 1	11.67	1,050	12.25	Fourth quarter 80		98	96	
	Electric furnace No 2	9.83	1,200	11.80	Fourth quarter 80		98	96	
	Total			24.05	70 to 80 days operation	1,680 to 1,920	98	96	1,580 to 1,800
1953 Plan	Electric furnace No 1	13.69	1,050	14.40	82	4,305	98	96	4,050
	Electric furnace No 2	12.00	1,200	14.40	82	4,305	98	96	4,050
	Total			28.80	299 days in operation	8,610	98	96	8,100

Table No 10-41 (Cont'd)

Year	Number of furnace	Effective utilization coefficient (ton per 1,000 kilovolt-ampere a day)	Capacity of transformer (kilovolt-ampere)	Daily steel output (tons)	Rate of operation (per cent)	Annual steel output (tons)	Ingot recovery rate (per cent)	Percentage of accepted steel ingots (crude steel) (per cent)	Annual output of good ingot (crude steel) (tons)
1954 (Estimate)	Electric furnace No 1	13.69	1,050	14.40	82	4,305	98	96	4,050
	Electric furnace No 2	12.00	1,200	14.40	82	4,305	98	96	4,050
	Electric furnace No 3	About 10.00	2,500	About 25.00	About 80	About 7,250	98	96	About 6,800
	Electric furnace No 4	About 10.00	2,500	About 25.00	About 80	About 7,250	98	96	About 6,800
	Total			About 78.80		About 23,110			About 21,700

Remarks

1. Figures for 1954 are a rough estimate.

2. An example of calculation (In the case of electric furnace No 1 in 1953)

Effective utilization coefficient		Capacity of transformer		Daily steel output		Calendar days		Rate of operation		Ingot recovery rate		Percentage accepted		Annual output of good ingot
11.67		1,050	= approximately	12.25	x	365 day	x	0.82	x	0.98	x	0.96	= approximately	4,050 tons
(tons per 1,000 kilovolt-amperes a day)		(kilovolt-amperes)		(tons a day)										

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Table No 10-44

Heating Furnace and Other Equipment of the Medium Bar Mill
(End of the first quarter of 1953)

Item	Japanese and Chinese Nationalist control	Chinese Communist control	
		Old facilities	New facilities
Number of heating furnaces	One	One	One
Heating capacity	Rated capacity, 200 tons a day	Rated capacity, 200 tons a day Actual output, 200 to 300 tons a day	Rated capacity, 400 tons a day Actual output, 500 tons a day
Type	Charge ---- pushing type } continuous heating Extraction ---- pulling type } furnace	Same as left	Two row type, pushing type, continuous heating furnace
Heat source	Coke oven gas and coal	Same as left	Coke oven gas } burned together Producer gas }
Steel bloom extracting platform system	Rotating type	Same as left	
Height of the above system from the ground	800 mm	Same as left	
Measurement (inner width) (length)	[illegible] mm 19,500 mm	1,800 mm 19,500 mm	3,600 mm 22,000 mm
Motor attached to the pusher	75 hp (one)	75 hp (one)	75 hp (two); one is in reserve
Gas burner	11 (Diameter of the burner nozzle, [illegible] mm)	Same as left (Only eight burners are used when coal is used at the same time)	16
Blower	One	Same as left	Two
Motor for the blower	25 hp	Same as left	75 hp (two)
Preheating system	This system which utilizes the exhaust gas is situated on top of furnace. Made in [illegible].	Same as left	This system which utilizes the exhaust gas is located underground
Roof			Suspended roof (a set of two chamotte bricks) Horizontal
Period constructed	Summer 1941		Late 1952

Note: After the two-row type heating furnace was newly established the old heating furnace is used only for heating electric furnace steel ingots.
The coke oven gas is sent from the coke plant. The amount of supply is insufficient.

Gas Producer (attached to the newly established two-row type heating furnace)
(End of the first quarter of 1953)

Item	Contents	Item	Contents
Number of gas produce s	One	Dust catcher	Capacity unknown
Type	Wood-type	Usage	For the newly established two-row type continuous heating furnace
Capacity	Burns 30 tons a day	Date constructed	Late 1952
Blower	20 horsepower	Coal used	Ta-tung Coal

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Table No 10-45

Accessory of the Medium Bar Mill
(End of the first quarter of 19[illegible])

		Quantity	Data	Usage and layout, etc	Period of construction
Overhead conveyance	Crane	[illegible]	Overhead traveling [illegible]-ton	[illegible] steel ingots	1941
		[illegible]	[illegible] traveling 10-ton	Conveying [illegible]	Late 1952
		[illegible]	[illegible] traveling 5-ton	Used for conveying [illegible] ingots and coal	Late 1952
Floor conveyance equipment	Roll [illegible]	[illegible]	[illegible] type [illegible]	Used for [illegible] from the newly established heating furnace	Late 1952
		[illegible]	Horizontal type [illegible]	Used for conveying products from finishing roll No 2	1941
		[illegible]	Incline, autorotation type, no motor	Used for conveying hot steel [illegible] heating furnace	1941
		[illegible]	[illegible] type [illegible]	Used for [illegible]	Changed layout at end of 1952
	[illegible]	[illegible]	[illegible] roll [illegible]	[illegible]	1941
		[illegible]	[illegible]	Used [illegible]	[illegible] at the end of 1952
		[illegible]	[illegible] (1) [illegible] (1)	Used for [illegible]	[illegible]
	Autorotation [illegible]	[illegible]	[illegible]	[illegible]	Same as above
		[illegible]	[illegible]	[illegible] for the front [illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible] the autorotation [illegible] of the finishing roll	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible] to roll	1941
		[illegible]	[illegible]	For [illegible]	1941
Cutting and processing equipment	Shearing machine	[illegible]	[illegible]	[illegible]	Changed layout at end of 1952
	[illegible] machine	[illegible]	[illegible]	[illegible]	1941
	[illegible]	[illegible]	[illegible]	[illegible] in rai[illegible]	1941
Straightening equipment	Roll [illegible]	[illegible]	[illegible]	[illegible]	1952
	[illegible]	[illegible]	[illegible]	[illegible]	1941
Roller changing equipment	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] the Nationalist era after the war
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Others	[illegible]	[illegible]	[illegible]		[illegible]
	Collecting [illegible]	[illegible]	[illegible]		
	[illegible]	One [illegible]			
Motors	[illegible]	[illegible]		[illegible]	[illegible]
	[illegible]	One		[illegible]	[illegible]
	[illegible]	[illegible]		[illegible]	[illegible]
				[illegible]	[illegible]
	[illegible]	Five		[illegible]	[illegible]
				[illegible] automatic [illegible]	[illegible]
	[illegible]	One		For [illegible]	Changed layout in 19[illegible] and at end of 1952
	[illegible]	[illegible]		[illegible]	[illegible]
	[illegible]	Two		[illegible] for the [illegible]	[illegible]
				[illegible] for roller [illegible] No 1	[illegible] Nationalist era after the war
	[illegible]	[illegible]		[illegible]	[illegible]
	[illegible]	One		For [illegible]	[illegible]
	[illegible]	[illegible]		[illegible]	[illegible]
	[illegible]	[illegible]		[illegible]	[illegible]
				[illegible]	
	[illegible]	[illegible]		[illegible]	[illegible]
				[illegible]	[illegible]
				[illegible]	Changed [illegible]

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Table No 10-46

Details on Production at the Medium Bar Mill (1953 plan)

Products		Coefficient for effective utilization (tons an hour)	Output in 24 hours (ton)	Annual rate of operation (per cent)	Number of days of around the clock operation in one yr	Percentage accepted (per cent)	Planned annual output (accepted tonnage)
Billet	To be used within this iron and steel works	23.5	564	75	178	99.5	60,000
	For outside sale						40,000
Sheet bar	Ordinary steel	11.0	264	75	72		14,500
	Silicon steel						4,500
Ordinary steel material		11.0	264	75	23		6,000
Total					273		125,000

Table No 10-47

Variations in Products Produced by the Medium Bar Mill

Product	Size			Remarks
	Japanese period	Chinese Nationalist period	Chinese Communist period	
Rail	8, 12, 15, 17, 20 and 25 kilograms	Same as left	Same as left	Light rail
Angle	50 mm by 50 mm to 75 mm by 75 mm	Same as left	Same as left	
Flat bar	100 to 150 mm wide $\frac{1}{4}$ to 1 inch thick	100 to 150 mm wide More than one mm thick	100 to 150 mm wide 8 to 16 mm thick	
Round bar	38 to 80 mm in diameter	Same as left	Same as left	
Square bar	38 to 80 mm in diameter	Same as left	Same as left	
Channel	⊔ 65 mm by 180 mm I 100 mm by 180 mm	Plan only	Plan only	Plan only throughout all periods

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Table No 10-47 (Cont'd)

Products	Size			Remarks
	Japanese period	Chinese Nationalist period	Chinese Communist period	
Billet	82 mm (thickness) by 1,300 mm 69 kg	Same as left	82 mm (thickness) by 1,450 to 1,650 mm 65 mm (thickness) by 1,450 to 1,650 mm	Four types during Chinese Communist period
Sheet bar	-	-	12 mm by 200 mm by about 5,700 mm	One type
Remarks	1. Production of channel steel was planned throughout the three periods but it has not been materialized due to necessity of grain rolls. Grain rolls are manufactured at the Wakamatsu Factory of the Hitachi Co, Ltd in JAPAN. However, it is reported that grain rolls of good quality cannot be produced in great quantity even in the USSR. 2. Seventeen-kilogram rails are used for narrow-gauge railways in SHANSI Province.			

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Table No 10-48

Comparison of Time Required for Replacement of Rolls

Work classification \ Period	Time required		
	Early stage of the Japanese control	Latter stage of the Japanese control	Chinese Communist control
Replacement of blooming rolls	Six hours	Four hours	1.5 hours
Replacement of one set of blooming rolls No 2 and No 3	Eight hours	Six hours	2.5 hours

Table No 10-49

Transition in the Supply of Rollers For the Medium Bar Mill

Date obtained	Usage	Quality	Number	Maker	Remarks
T'ai-yuan Steel Mill era (1936)	For blooming	Forged steel roll	3	ZAKKU* of GERMANY	For one set
	For 17-kg rails	Same as above	3	Same as above	Same as above (for roughing mill No 1)
	For 17-kg rails	Cast steel roll	3	Same as above	Same as above (for finishing mills)
Japanese control (ordered from JAPAN in July 1941 and obtained in January 1942)	For blooming	Forged steel roll	4	Muroran Steel Works	
	For blooming	Grain roll	4	Nippon Steel Works	
	For bar steel	Same as above	5	Wakamatsu Plant of the Hitachi, Limited	
	For various shaped steel	Grain and chilled rolls	3 2	Same as above	
	For plain rolling	Grain roll	8	Same as above	Reserve rolls without passes
Chinese Nationalist control	For blooming	Cast steel roll	About 15	Steel manufacturing plant within this iron and steel works	

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Table No 10-49 (Cont'd)

Date obtained	Usage	Quality	Number	Maker	Remarks
Chinese Communist control	For 32-kg rails	? (TN Sic.)	8	An-shan Iron and Steel Co	The quality of material is not same; soft and weak; not endurable (obtained in 1951)
	For blooming	Cast steel roll	Unknown *	Steel manufacturing plant within this iron and steel work	* Produced more than the amount produced in the Nationalist era
	For blooming	Chilled roll	About 100	Same as above	610 tons (about 100 rolls) in 1952
	For steel material (? [TN Sic.])	? (TN Sic.)	A little		Imported from the USSR (? [TN Sic.])

Note: 1. Prior to the war, reserve rolls were not ordered from the ZAKKU* Company. When the Chinese Communists took control, the question arose that these rolls were probably hidden underground and therefore, the Chinese Communist authorities dug around looking for them but could not find them.

2. At the open-hearth furnace plant, rolls are cast by a special mold (metal on the outside and dolomite in the inside) at the ingot making pit.

3. Types and sizes of products are set according to the caliber of the rolls.

Table No 10-50

Order List For Medium Rolls at the T'ai-yuan Iron Manufacturing and Mining Office (1941) (Reference)

Type	Size	Number: For roughing mill	Number: For finishing mill	Remarks
For round bar		3	2	1. Grain roll
For angle steel	100 mm by 100 mm	3	2	Chilled roll
	90 mm by 90 mm	3	2	Forged steel roll
	75 mm by 75 mm	3	6	2. Ordered from JAPAN
	65 mm by 65 mm	3	6	
	50 mm by 50 mm		4	
For rail	8 kg	3	6	
	17 kg	3	6	
For flat bar		3		
			2	
For bloom		4		
		4		
Plain roll	750 mm in diameter	8		
Total		76		

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Table No 10-51

Equipment of the Small Bar Mill
(End of the first quarter of 1953)

Nomenclature			Before Chinese Communist control	After Chinese Communist control	Outline of improvements	Remarks
Number of sets			One	One		
Rated capacity			15,000 tons annually	15,000 tons annually		
Actual capacity				54,000 tons annually (1953)	The capacity was increased mainly due to new installation of a motor.	
Roughing Mill	Number		One	One		
	Type		Three-high	Three-high		
	Diameter of rolls		360 mm	360 mm		
	Length of rolls		1,000 mm	1,000 mm		
	Number of revolutions		90 rpm	120 rpm	Increased output in late 1952	The rolling speed was increased by 33 per cent.
	Maker		GERMANY	GERMANY		Originally a copper-plate rolling mill.
	Date of manufacture		Before 1937	Before 1937	Increased the stand strength (Newly casted)	
	Drive	Pulley	1,200 mm in diameter └┘ shape, seven	---		Seven $1\frac{1}{4}$-inch cotton ropes are used as belts.
		Flywheel	3,800 mm in diameter, one	---		Rotary flywheel
		Reduction-gear	--	One set (Used in place of flywheel)	Increased to 120 rpm from 90 rpm	
		Pinion	Three	Three		Reverse rotation of the upper, middle, and lower rolls by gear
	Motor			400 horsepower, one	The rolling process was reduced from nine passes to seven passes. Also, the number of objects processed at one time was increased from one to three.	Used motor installed in late 1952.
Finishing Mill	Number		Seven	(Remodelled) Seven	Stands were replaced and strengthened (Newly casted)	Originally copper material rolling mills
	Type		W two-high rolls	W two-high rolls		
	Diameter of rolls		280 mm	280 mm		
	Length of rolls		500 to 700 mm	700 mm		Owing to a shortage of old rolls, the length of rolls was adjusted to that of newly obtained rolls.
	Number of revolutions		280 rpm	300 rpm	Increased output in late 1952	
	Maker		GERMANY	GERMANY		
	Date of manufacture		Before 1937	Before 1937		
	Drive	Gear	Two	Two		Rotates rolling mills in two rows by gears
		Pinion	Two	Two		Reverse rotation of the upper and lower rolls by gears
		Reduction-gear	One	One	Increased from 280 rpm to 300 rpm.	
	Motor		--	1,000 horsepowers, one		New motor, installed in late 1952

Note: 1. As shown on this table, prior to Chinese Communist control the pulley attached to finishing rolls and the flywheel of the roughing rolls were operated by gears. Seven 1.25-inch cotton ropes were used. A 1,500-horsepower motor (720 rpm, 2,200 volts, 60 cycle) at the medium bar mill was then used jointly.

2. The finishing mills consist mainly of the German-made copper-plate rolling mills which were in TSING TAO. Others were collected from the then Central Factory (the present T'ai-yuan Machinery and Tool Plant) and those scattered within SHANSI Province. The number of rolling mills collected within the province was five.

3. Finishing rolls, 280 mm in diameter and 500 mm in length, were originally German-made rolls for rolling copper. Finishing rolls, 280 mm in diameter and 700 mm in length, are Japanese products or those produced at the roller plant within this iron and steel works.

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Table No 10-52

Accessory Equipment of the Small Bar Mill
(End of the first quarter of 1953)

Nomenclature		Before Chinese Communist control		After Chinese Communist control		Remarks
		Number of equipment	Data	Number of equipment	Data	
Winder	Winder	One	Upper diameter of the reel 750 mm Lower diameter of the reel 800 mm Height of the reel 500 mm	One	Same as before	
	Reduction-gear	One		One	Same as before	Manufactured by the Shimazu Factory.
	Motor	One	7.5 hp	One	15 hp	
Shear	Shear	One	Unknown	One		Manufactured by the Nakayama Iron Works in TIENTSIN
	Motor	One	Unknown	One		
Cooling bed	Cooling bed	One set	Inside dimension 2.5 m Outside dimension 3.0 m Length 45 m	One set	Width -- same Length -- 55 m	There is a mechanism to transport steel material on one side.
	Motor			One	For automatic feeding Output unknown	
Suspension lever		One set	Suspended equipment guide.	One set	Same as before	An auxilliary equipment to transport heated billets from heating furnaces.
Rollgang		One set	Automatic roller table Length -- 5 m Diameter of rolls -- 150 mm	One set	Same as before. Newly installed a motor (7.5 hp)	For roughing mill.
Portable ground crane		One	Gasoline engine Carrying load -- 1 ton	One	Same as before	Used for transporting billets from the medium bar mill.
Finishing stand		One set	Width -- 4 m Length -- 10 m	One set	Enlarged the width to six meters and the length to 10 meters.	
Wire rod storage area		One set	Outdoor outside (east) the winder	One set	Same as before Enlarged	Old rails are placed in rows.
Steel material storage area		One set	Outdoor outside the finishing stand	One set	Same as before Enlarged	Old rails are placed in rows.
Product straightener		Unknown		Unknown		

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Table No 10-53

Heating Furnace for the Small Bar Mill (End of the first quarter of 1953)

Nomenclature	From the end of 1943 to the end of 1952	After the end of 1952	Nomenclature	From the end of 1943 to the end of 1952	After the end of 1952
Number of furnace	One	One (Remodelled)	Number of steel ingot layers	One	Two
Heating capacity	60 tons a day*	200 tons a day	Steel ingot pusher type	Forced feeding	Same as left
Length of furnace	Seven meters	12 m	Feeding speed		2.5 meters a second
Width of furnace	Two meters Inside width - 1.7 m	2.3 m Inside width - 2.0 m	Steel ingot extraction type	Manual extraction	Same as left
Height of the furnace hearth	0.8 m	0.8 m	Number of extraction doors	Two (one is used for separating steel ingots stucked together)	Same as left
Ratio of the heating area to the hearth area	100 to 12	100 to 14	Fuel	Direct burning of coal	Same as left
Rise of the roof	Unknown	100 mm	Motor for the charging machine	10 hp	15 hp 1,200 rpm

Note: Constructed in late 1943 and remodelled in late 1952.

Table No 10-54

Improvements of Facilities of the Small Bar Mill (End of the first quarter of 1953)

Facilities	Improvements	Improvements made in	Results of improvements	Remarks
Independence of power source for rolling mill	1. Discontinued the joint use of motors with the medium bar mill and newly installed motors exclusively for small bar rolling 2. For roughing - 400 hp For finishing roll - 1,000 hp	Late 1952	Separated from the medium bar rolling operation and became possible to adopt an assembly-line system of operation	
Increase of the number of revolutions of rolls	3. Increased the rolling capacity of roughing mill Number of revolutions - from 90 to 120 Number of charging billets - from 1 to 2 Number of rolling process - from 9 to 7 4. A set of reduction-gear was used in the place of the flywheel	Late 1952	The rolling capacity was increased by 3.5 times	
	5. Increased the rolling capacity of finishing mills Number of revolutions - from 280 to 300 rpm			
Remodeling of roll stands	6. Remodelled and increased the strength of finishing-mill stands		Facilitated repair during breakdown. Increased the load capacity.	Stands in the past were for coppэr-plates

Table No 10-54 (Cont'd)

Facilities	Improvements	Improvements made in	Results of improvements	Remarks
Rearrangement of equipment layout	7. Moved back finishing mills (Moved back eight meters to maintain about 20 meters between the front and back mills) 8. Moved winders cooling beds, finishing stands, and shears along with above.		To cope with increase of billets	
Automatic rollers for cooling beds	9. Newly installed automatic rollers for cooling beds. (Newly installed motors and gears)		Conservation of workers	Pushed by manpower in the past (rollers)
Heating furnace	10. Increased the capacity of heating furnace		Increased from 60 tons a day to 200 tons a day	

Note: The transportation of heated billets from the heating furnace to the roughing mill has not yet become automatic.

Repeaters between finishing rolls have not been installed.

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Table No 10-55

Distribution of Key Workers in the Small Bar Mill (End of the first quarter of 1953)

Work position		Number of workers
Person in charge of workshop		1
Portable crane		2
Heating furnace	Bloom hauling	4
	Charging	1
	Heating	6
	Transporting of heated bloom	2
Roughing roll	Front	2
	Rear	4
	Operators	1
Finishing roll	No 1 Stand	3
	No 2 Stand	2
	No 3 Stand	2
	No 4 Stand	2
	No 5 Stand	2
	No 6 Stand	2
	No 7 Stand	2
	Operators	2

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Table No 10-55 (Cont'd)

Work position		Number of workers
Rail rod rolling	Cooling bed	2
	Transporting	2
	Shearing machine	2
	Measurement	1
	Transporting and loading	2
Wire rod rolling	Reel transporting	1
	Reeling	2
	Transporting	6
Outside transportation		4
Outside arranging		6
Marking and voucher		3
Total		82

Note: 1. Beside those listed in this table, there was one plant manager who served at the mill office (location of the medium bar mill)

2. Repair workers and warehouse keepers also served at the medium bar mill. Hence, they are not listed in this table.

3. Number of personnel in the field of administration and machinery and electricity are not known. Hence, they are not listed.

4. As the mill was operated on the assembly-line system, each shift had some reserve personnel; however, their number was not known.

5. If the aforementioned unknown number of personnel were added, the total number of personnel will probably reach 150 to 170 in one shift.

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Doc No [illegible] (1[illegible]) ([illegible])

Table No [illegible]-50

Changes in Actual Daily Output at the Small Bar Mill

Products	Mark	Prior to Chinese Communist control		First quarter of 1953	
		Size	Actual daily production	Size	Actual daily production
Wire rod		Diameter 6 mm	[illegible] tons a day	[illegible]	[illegible] tons a day
Round bar	[illegible]	Diameter [illegible] and [illegible]	[illegible] tons a day	Diameters of [illegible] and 30 [illegible]	[illegible] tons a day
Square bar	□	Thickness of [illegible]	Thickness of over [illegible] tons a day	Thickness of [illegible] and [illegible]	[illegible] tons a day
Flat bar	▭	[illegible]	[illegible] tons a day	[illegible]	[illegible]
Concrete bar	[illegible]	–		Diameters of [illegible]	[illegible]
Remarks	1. In [illegible] cases, [illegible] volume based on the production of one item. [illegible] two items, the daily production of each item [illegible].				
	[illegible]. [illegible] instead of [illegible].				

[illegible]

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Doc No 90[illegible] 5 (10) (18)

Table No 10-57

[illegible]

Period of replenishment	Quality	Number of rolls	Purchased from	Note
Japanese controlled era	Chilled	Few	[illegible] Company	Rolls for [illegible] were [illegible]. Depth of chill 15 mm, hardness [illegible] degrees, superior quality
	Chilled	1	[illegible] Factory of [illegible], Limited	
	Grain	30	Wakayama Factory of Hitachi, Limited	
Chinese Nationalist controlled era	Chilled	Few	[illegible] and [illegible]	Only 2[illegible] per cent were usable. Poor quality
Chinese Communist controlled era	Chilled	[illegible]	[illegible] Plant	End of 19[illegible], thirty rolls were [illegible]. [illegible] rolls were received [illegible]
	[illegible]	[illegible]	[illegible]	Until 195[illegible], about [illegible] per cent were [illegible]. [illegible] sufficient

Note: 1. [illegible] of 195[illegible], were [illegible] [illegible] to [illegible]

2. [illegible], the [illegible] [illegible] to [illegible] degrees.

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Doc No 90225 (10) (PB)

Table No 10-58

Details of the Sheet Mill (End of the first quarter of 1953)

Name	Number		Type	Details	Manufacturer	Date of manufacture	Remark
Roughing mill	Two	Two set	2-high, pull-over type	Roll — diameter 75[illegible] mm Body length — 1,150 mm Number of revolution — 3[illegible] rpm Rated capacity — ([illegible] set) 1[illegible],[illegible] tons	JAPAN Tobata Casting Manufacturing Company	19[illegible]7 (imitation of the Yawata Iron Work's product of about 1921)	It is reported that the roller is 30 inches in diameter and 45 inches in length
Finishing mill	Four						
Drag mill (friction roll)	Two			Roll diameter — 660 mm Body length — 1,150 mm Number of revolution — 30 rpm	Communist CHINA Manufactured in SHANGHAI (Designed by Japanese)	1952	Utilizing rejected cold roll
Motor	One			Output — 1,[illegible] Number of revolution — [illegible] rpm Voltage — [illegible],[illegible] volts Frequency — [illegible] cycles	Communist CHINA Manufactured in SHANGHAI (Designed by Japanese)	1952	Judging from its output, the designation of "manufactured in SHANGHAI" is questionable. It may be a reconditioned motor
Reduction gear	One set		Double helical gear	[illegible] Number of revolution No 1 shaft — [illegible] No [illegible] shaft — [illegible]	[illegible]	[illegible]7	

Note: Coupling SINKING, spindle and other [illegible] [illegible] are not listed.

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Doc No 90225 (10) (PB)

Table No 10-59

Details of Furnace Facilities of the Sheet Mill
(End of the first quarter of 1953)

Name	Number		Type	Details	Manufacturer	Date of manufacture	Remarks
Material heating furnace (Crude furnace)	2	Two sets of rolling mills	Straight continuous type	Inner width -- 1,[illegible] mm Inner length -- 7,[illegible] mm Inner height -- [illegible]0 mm Producer gas burning type	Communist CHINA T'ai-yuan Iron and Steel Works	1952	
Material charging machine	2			Motor 10 hp	Communist CHINA T'ai-yuan Machinery and Tool Plant	1952	
Foil sheet heating furnace	4			Inner width -- [illegible] mm Inner length -- [illegible] mm Producer gas burning type	Communist CHINA T'ai-yuan Iron and Steel Works	1952	
Gas producer	2		Wood type	[illegible]	Communist CHINA T'ai-yuan Iron and Steel Works	1952	One reserve gas producer
Gas producer blower	1			Motor [illegible] hp	Communist CHINA [illegible]	1952	
Gas producer coal hoisting tower	1			Winch motor [illegible] hp	Communist CHINA T'ai-yuan Machinery and Tool Plant	1952	
Gas producer dust collecting tank	1				Unknown	1952	Dust catcher
Continuous annealing furnace	1		Continuous type	Inner width -- [illegible] Inner length -- [illegible] [illegible] capacity -- [illegible] Producer gas burning type	Communist CHINA T'ai-yuan Iron and Steel Works	1952	Flatcars and parts were ordered from other plants
Annealing furnace charging machine	1			Motor [illegible] hp	Communist CHINA T'ai-yuan Machinery and Tool Plant	1952	
Single-type annealing furnace	1		Single type, Batch model	[illegible] capacity -- 2	Communist CHINA T'ai-yuan Iron and Steel Works	1952	

Doc No [illegible] (10, (-2)

Table No [illegible]

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Details of Accessory Equipment of the Sheet Mill [illegible]

Name		Number	Type	Detail	Manufacturer	Date [illegible]	Remarks
Shearing machine	[illegible] shearing machine	-		Length -- 6,[illegible] mm Motor for shearing -- Motor for conveying table -- [illegible]	Communist CHINA Manufactured in [illegible]	[illegible]	Used for cutting sheet bar
	[illegible] shearing machine	[illegible]		Length of blade -- [illegible] mm Stroke count -- 15 times per minute Motor -- 10 [illegible]	Communist CHINA Manufactured in [illegible]	[illegible]	
Doubling machine	[illegible] shearing machine	2		Length of blade -- [illegible] mm Stroke count -- 15 times per minute Motor -- 15 [illegible]	One was manufactured in [illegible] [illegible]	[illegible]	
	Plate [illegible] doubling machine	4		Stroke count -- [illegible] times per minute Motor -- 15 [illegible]	Manufactured in JAPAN	[illegible]	
Straightener	Roll [illegible] ([illegible] roll straightener)	1		Roll diameter -- [illegible] Body length -- [illegible] Number of rolls -- [illegible] Motor ([illegible]) -- [illegible] hp	Communist CHINA Manufactured in [illegible]	[illegible]	Also reported to be [illegible] inches in diameter and 45 inches in length
	[illegible] sheet straightener	[illegible]	[illegible]	Roller [illegible] Number of rollers -- [illegible] Motor [illegible] -- [illegible] hp	Manufactured in [illegible]	[illegible]	
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible] processing
	[illegible]			[illegible]	[illegible]		
	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]
[illegible]	[illegible]			[illegible]	[illegible]		[illegible]
	[illegible]			[illegible]	[illegible]		[illegible]
	[illegible]			[illegible]	[illegible]		
[illegible]	[illegible]	[illegible]		[illegible]			
	[illegible]			[illegible]			
	[illegible]			[illegible]			
	[illegible]			[illegible]			
	[illegible]			[illegible]			[illegible]
[illegible]	[illegible]			[illegible]	[illegible]		
	[illegible] press						
	[illegible]	1					
	[illegible]	-					
	[illegible]	-					
	[illegible]	[illegible]			Communist CHINA	19[illegible]	[illegible] boiler for reserve
[illegible]	[illegible]		[illegible]		Communist CHINA	19[illegible]	
	[illegible] board room	Set					

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Doc No 90225 (10) (PB)

Table No 10-61

Distribution of Workers in the Sheet Mill
(January 1953)

Assigned position	Number of Workers	Remarks
Locomotive crane	2	
Material storage yard	4	
Material shearing machine	4	
Crude furnace	4	Charging -- one worker Front door -- 3 workers
Foil sheet furnace	8	Two furnaces; four men to each furnace
Motors	3	1,500 hp
Roughing mill	5	
Finishing mill	8	Two mills; four men to each mill
Doubling machine	2	Two machines; one to each machine
8-Shaku shearing machine	4	
4-Shaku shearing machine	3	
Cold roller	3	
Roll lathe	2	
Continuous annealing furnace	5	One worker for charging machine
Multiple spindle sheet straightener	4	
Crane	3	Three cranes; one to each crane
Single-type annealing furnace	1	
Coal hoisting tower	2	
Gas producer	3	
Boiler room	2	
Switchboard room	1	
Miscellaneous work	5	Work in finishing operation shop
Inspection	4	Work in finishing operation shop
Warehouse	3	
Total	85	

Note: Number of workers in this table is limited to one shift of set No 1 that was in operation in January 1953.

Table No 10-62

Estimated Capacity of Sheet Rolling Facilities
(Late 1952)

Size of products			Daily production capacity (ton)	Monthly production capacity (ton)	Yearly production capacity (ton)	Number of rolling mills
Thickness (mm)	Width (mm)	Length (mm)				
1.2	900	1,800 to 2,000	180	4,000	48,000	Two sets
(No 29) 0.35	900	1,800 to 2,000	84	1,700	20,000	

Note: Production capacity of the various sizes of products in the above table indicates the capacity only when the said sizes of products were specialized in production.

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Table No 10-63

Production Plan for Various Products of the Sheet Mill
(1953)

Product	Size (mm)			Unit weight (kg)	Output (ton)		Summary
	Thickness	Width	Length				
Silicon steel plate	0.35	900	1,800	4.45	1,500	3,500	1. Rolling mill -- 2 sets
	0.5			6.36	2,000		2. Operational period -- About half a year
Ordinary steel plate	0.35	900	1,800	4.45	1,000	11,000	3. First year of operation
	0.5			6.36	1,000		4. Figures indicate accepted products
	0.6			7.63	1,000		
	1.0			12.72	4,000		
	1.2			15.26	4,000		
Total						14,500	

Table No 10-64

Chilled Casting Equipment
(End of the first quarter of 1953)

Item	Number	Type	Capacity	Manufacturer	Date of Manufacture	Date commenced operation	Others
Reverberatory furnace	One		Rated -- 15 tons Actual -- 20 tons	Communist CHINA	1951	Late 1951	Designed by Japanese technician. Fuel -- coal Capacity (ton) is the volume
Cupola	One	Vertical	5 tons	T'ai-yuan Iron and Steel Works	Before the end of the war	Late 1951	Low air pressure blown from the side.
Converter	One	Bessemer (small-base)	6 tons	T'ai-yuan Iron and Steel Works	Before the end of the war	Operation impossible owing to poor performance	Designed by Japanese technician. The purpose was to blow the half-blown steel
Crane	One	Overhead traveling	Unknown	Unknown	1946 - 1948	Late 1951	
Equipment at the ingot molding yard	One set						

Table No 10-65

Actual Production of Chilled Castings
(1952)

Item	Quality	Number	Unit weight	Output	Summary
Sheet roll	Chilled	--		--	1. Trial manufacture of small bar rolls took place in late 1951. 2. Full-scale output of small bar rolls commenced from mid-1952
Medium bar roll		Trial operation	About 6 tons	Some	
Small bar roll		20 to 30	About 400 kg About 500 kg	100 to 150 tons	
Machinery parts	Semi-chilled			450 to 500 tons	
Others					
Total				610 tons	

Note: Trial manufacture of sheet rolls commenced from spring 1953.

Weight of finished small bar roll was roughing roll 470 kilograms, and finishing roll 350 kilograms.

Table No 10-66

Amount of Refractory Material Consumption

Division	1942 fiscal year (peak before the end of the war)	1952	1953	1957 Plan
Pig-iron Manufacturing Department	(Pig iron 44,000 tons x 0.05) 2,200 tons	(Pig iron 130,000 tons x 0.04) 5,200 tons	(Pig iron 151,000 tons x 0.04) 6,000 tons	
Open-hearth Furnace Steel Manufacturing Department	(Steel 36,000 tons x 0.14) 5,000 tons	(Steel 91,000 tons x 0.12) 10,900 tons	(Steel 130,000 tons x 0.12) 15,600 tons	
Electric Furnace Steel Manufacturing Department	--	Some	(Steel 8,000 tons x 0.02) 160 tons	
Casting Department	--	(Chilled 610 tons x 0.05) Some	Some	
Coke Department	(Lump coke 82,000 tons x 0.02) 1,600 tons	(Lump coke 194,000 tons x 0.02) 3,800 tons	(Lump coke 290,000 tons x 0.02) 5,800 tons	
Others such as flue and smokestack	Ten per cent of the total fireproof materials 1,000 tons	Ten per cent of the total fireproof materials 2,000 tons	Ten per cent of the total fireproof materials 3,000 tons	Ten per cent of the total fireproof materials 6,000 tons
Total	9,800 tons	21,900 tons	30,560 tons	60,000 tons

Note: Production figures on pig iron, steel and coke below 1,000 tons were omitted.

Table No 10-67

Principal Facilities in the T'ai-yuan Power Plant No 3
(End of the first quarter of 1953)

Name	Number	Manufacturer and type	Details	Summary
Generator	Two	GERMANY, AEG	Capacity 5,000 kw Revolution 1,500 rpm Frequency 50 cycle	
	One	GERMANY, Siemens	Capacity 6,000 kw Revolution 1,500 rpm Frequency 50 cycle	
Turbine	Two	JAPAN, Hitachi	Capacity Revolution 1,500 rpm	
	One	GERMANY	Capacity Revolution 1,500 rpm	
Boiler	Two	GERMANY, GIRUJITSUSHU*	Evaporative capacity 20 tons an hour	Pulverized coal and gas dual-burner type
	One	ENGLAND, Babcock	Evaporative capacity Unknown	
	Two	Small type	Evaporative capacity Unknown	
Blower	Three			

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Table No 10-68

Equipment in Boiler Room No 2
(End of the first quarter of 1953)

Type	Number	Diameter	Length	Evaporative capacity	Constant blowing pressure
Lancashire boiler	Five	Six shaku	25 shaku	2,000 kilograms an hour	90 lb
KORUNITSUSHI* boiler	One			1,500 kilograms an hour	

Note: Two smokestacks: height 45 meters, diameter of lower part 3,500 millimeters, diameter of upper part 1,600 millimeters.

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Table No 10-69

Physical Test Equipment
(End of the first quarter of 1953)

Name of equipment		Number	Model	Details	Manufacturer	Date acquired	Summary
Tension tester		One	Amsler	Capacity, 30 tons	JAPAN, Shimazu Factory	1940	Secondhand equipment more than 15 years old.
Hardness tester		One	Brinell (H. B.)		Unknown	Before the end of the war	
		Two			West GERMANY RUISUSHOPPA*	Late 1952	
		One	Rockwell (H. R.)		JAPAN	Before the end of the war	
		Two			East GERMANY	Late 1952	
		One	Shore (H. S.)		JAPAN	Before the end of the war	
		Two			East GERMANY	Late 1952	
Impact tester		One			Unknown	Late 1952	
Metallurgical microscope		One	Olympus	1,000 power, medium type	JAPAN	Before the end of the war	
		One	Zeiss	1,000 power, dark field	GERMANY, Zeiss	Before the end of the war	Cannot be used because there is no URUTORAPAKU* reflector
		One	Horbolt	1,000 power, large type camera attached	BRITAIN, Horbolt	Mid-1952	
		One	Polarization microscope	1,000 power	GERMANY, Reitz	Late 1952	
Universal tester		One	RUISUSHOPPA*	Capacity, 100 tons Automatic type	West GERMANY RUISUSHOPPA*	Late 1952	
Hydrogen ion concentrated electricity measuring instrument		One			East GERMANY	Late 1952	
Electric furnace for testing purposes		One	Siemens	Automatic type, capacity of the transformer, 10 kilowatts	GERMANY Siemens	Late 1952	
		One		Automatic type, capacity of the transformer, five kilowatts			
Balance		Some			Mostly Japanese products	Before the end of the war	
Manufacturing equipments also used for testing	Lathe	One	Ordinary	Length, eight shaku	JAPAN Okegai Iron Works	Before the end of the war	
		Four			Unknown		
					CZECHOSLOVAKIA	Mid-1952	
	High-speed lathe	One					
					Unknown	Before the end of the war	
	Shaper	One			Unknown	Before the end of the war	
	Drill press	One					

Note: 1. Testing equipment were increased epochally by importing foreign products in late 1952.

2. Expensive automatic products were included among the imported products.

3. Five universal testers were imported into Communist CHINA in late 1952 and one of these testers was distributed to the Technical Office of the Peiping Iron and Steel Industry Control Bureau, T'ai-yuan Iron and Steel Works, T'ai-yuan Heavy Machinery Plant and the T'ang-shan Steel Works. It was first put into operation at the T'ai-yuan Iron and Steel Works. It is claimed that one of these equipment costs 2,400,000,000 yuan (about 37,000,000 yen).

4. The electric furnace for testing is an electric muffle furnace. It is automatically operated. It took two years to import this furnace.

Table No 10-70

Chemical Products

Products	Specifications	Usage
Crude naphthalene	Naphthalene content 45 to 50 per cent	For manufacturing refined naphthalene, and others.
Liquid ammonia	Concentration of more than 19 per cent; specific gravity (15.5°C) 1.06 to 1.08; light yellow; contains carbon dioxide.	For manufacturing alkali, ammonium sulphate and others.
Motor benzol	Light yellow; specific gravity (15.5°C) 0.87; first stage fractional distillation test 76°C to 82°C; at 100°C, more than 70 per cent of distillate; at 120°C, more than 90 per cent of distillate; ignition temperature less than 170°C.	For automobile motor use, rubber, and solvent of paint

Table No 10-71

Specifications For Coke

Water	Sulphur	Ash	Volatile matter	Fixed carbon	Drop test	Porosity
More than 3 per cent	More than 1.2 per cent	More than 14 per cent	More than 3 per cent	More than 82 per cent	84 to 88 per cent	40 to 50 per cent

Table No 10-72

Specifications For Gypsum

SiO_2	Al_2O_3	MgO	$CaSO_4$	Ignition loss
0.08 per cent	2.48 per cent	1.47 per cent	75.14 per cent	20.83 per cent

Table No 10-73

Specifications For Carbide

CaC_2	Gassing amount
More than 90 per cent	285 (? /TN Sic./) kin (TN One kin is equal to 600 grams) per kilogram

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Table No 10-74

Specifications For Coke By-products

Items	Specifications	Usage
Coal-tar	Moisture more than 4 per cent (weight); specific gravity 1.05 to 1.30 (15.4°C); free carbon 8 per cent	For road pavement; wood preserving and coating; carbolic acid and naphthalene materials
90 per cent industrial benzene	Colorless; specific gravity (15°C) [illegible] to 0.884; first stage fractional distillation test more than [illegible].2°C; at 100°C, distillate more than 90 per cent; ignition temperature 150°C; pickling test below No 6 standard tone	Dye, explosive, power, rubber, paint material or solvent
Anthracene	Specific gravity (38°/15.5°C) 1.[illegible] to 1.1[illegible]	Fuel, road pavement by mixing with pitch
Refined naphthalene	Also called camphor; white flake; melting point 78°C to 80°C; purity more than 93 per cent	Ball naphthalene, explosive, dye, disinfective, antiseptic
Crude naphthalene	Purity 15%; insoluble matter less than 0.5% per cent	Dye material, fumigation insecticide
Asphalt	Melting point 35° to 45°C; specific gravity (25°C) 1.10 to 1.35; ash content less than 0.5 per cent (weight); the melting point can be established by the purchaser within the limitation	Road pavement, manufacture of insulator, building paint
Pitch	Melting point 90°C to 120°C; specific gravity (25°C) 1.10 to 1.35; ash content less than 0.5 per cent (weight); the melting point can be decided by the purchaser within the limitation	Road pavement, battery, and insulator
Ammonium sulfate	Moisture more than 0.5 per cent; ammonia less than 25 per cent; free acid none; purity more than 97 per cent	Quick-acting fertilizer
Industrial crude carbolic acid	Specific gravity (45°/45°C) 1.050 to 1.064	Medicine, ebonite, explosive, disinfective
Refined carbolic acid for medicine	Specific gravity (1.038 to 1.050)	Same as above

Table No 10-75

Specifications For Silica Fire-proof Materials

Item / Grade	SiO_2 (per cent)	Refractoriness (S.K.)	Size of granules (More than 0.2 mm)	
A	Less than 91	30 to 32	Less than 70 per cent	Mesh of over 0.8 mm
B	Less than 90	29 to 30	Less than 70 per cent	

Use: Silica bricklaying binder

Table No 10-76

Specifications For Alumina Fire-proof Materials

Item / Grade	Al_2O_3 (per cent)	Refractoriness (S. K.)	Ignition loss (per cent)	Size of granules (0.2 mm maximum)	Remarks
Special	Less than 40	32 to 33	More than 6	Less than 50 per cent	
A	Less than 30	31 to 32	More than 8	Less than 50 per cent	Mesh of over 1.2 mm
B	Less than 28	29 to 30	More than 8	Less than 50 per cent	
C	Less than 26	29	More than 8	Less than 50 per cent	

Use: Binder for laying firebricks

Doc No [illegible] (m) ([illegible])

Table No 10-77

Specifications For Fire Clay

1. Physical nature

Grade \ Item	[illegible]	Softening point	Volume density	Porosity	[illegible]	Cold compressive strength
	[illegible]	[illegible]	Grams per cubic centimeter	Per cent		
Special	[illegible]	[illegible]	Less than [illegible].0	More than [illegible]	More than 0.5 per cent (1500°C = short time)	More than 1[illegible]0
A	[illegible]	[illegible]	Less than [illegible].0	[illegible]	More than 0.5 per cent (1400°C = short time)	More than 100
B	[illegible]	[illegible]	Less than [illegible].0	More than [illegible]	[illegible] cent (1[illegible]°C = [illegible] time)	More than 85
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Less than 0.5 [illegible] cent (1[illegible]00°C = [illegible])	More than 85

[illegible] used for [illegible] furnace.

2. [illegible] composition

Grade	[illegible]	SiO_2	Fe_2O_3
Special	[illegible]	[illegible] than 50	More than [illegible]
A	[illegible]	[illegible] 56	[illegible]
B	[illegible]	[illegible] 65	[illegible] 3
[illegible]	[illegible]	[illegible]	[illegible] than 3

3. [illegible] form [illegible]

a. [illegible] per cent or more.

b. [illegible]

c. [illegible]

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Doc No 90225 (10) (PB)
Table No 10-78

1. Physical nature

Specifications For Silica Brick

Item / Grade	Refractoriness	Softening point	True specific gravity	Volume density	Porosity	Heating expansion	Cold compressive strength
	S. K.	2 kilograms per square centimeter		Grams per cubic centimeter	Per cent	1500°C = short time	Kilogram per square centimeter
A	Less than 33	(Compression [m]7 20 per cent) Less than 1600°C	More than 2.33	Less than 1.7	More than 23	More than 0.5 per cent	Less than 200
B	Less than 31	(Compression [m]7 20 per cent) Less than 1500°C	More than 2.35	Less than 1.7	More than 25	More than 0.7 per cent	Less than 150

Use: It is used in constructing ceiling wall of coke oven and steel manufacturing furnace, gas ports of electric furnace and open-hearth furnace, and regenerator.

2. Chemical composition

Composition / Grade	SiO_2	Al_2O_3	CaO
A	Less than 95	More than 1.5	More than 2.3
B	Less than 92	More than 2.0	More than 2.5

3. Permissible variations in dimensions and transformation

a. Permissible variations in dimensions: Less than 100 mm ± 0.25 per cent; 100 to 300 mm ± 1.5 per cent; over 300 mm ± 1.0 per cent.

b. Transformation: Less than one per cent of diagonal.

c. Dimensions of standard brick: 230 mm by 115 mm by 65 mm.

Table No 10-79

Specifications For Roll (Chilled cast iron)

1. Chemical composition

Carbon	Silicon	Manganese	Phosphorus	Sulfur	Remarks
3.00 to 3.50 per cent	0.55 to 0.70 per cent	0.30 to 0.60 per cent	Less than 0.55 per cent	Less than 0.08 per cent	The depth and hardness of chill is determined by usage.

2. Usage of product

For steel plate, alloy plate, and small wire rod rolling.

3. Dimensions and casting weight

The standard dimensions are determined by the request of purchasers. Casting weight 350 to 470 kilograms.

4. Specifications

a. Average hardness at the central surface of the roll is R.H. 60 to 70

b. Chilled depth (mm) of roll is 25 to 40 (decided by usage)

c. Neck must be tough and possess properties of a cast iron.

Table No 10-80

Specifications For Triangule Bars

Cross-sectional dimensions (mm)	Cross-sectional area (mm^2)	Weight (kg/m)	Maximum tolerance			
			Length		Width	Thickness
			Average user	Special designated person		
50 x 50 x 7	6.56	5.15				
50 x 50 x 9	8.24	6.47	± 50	± 10	± 1.0	± 0.5
50 x 50 x 10	9.055	7.11				
75 x 75 x 7	10.10	7.94				
75 x 75 x 8	11.50	9.05	± 50	± 10	± 1.50	± 0.75
75 x 75 x 10	14.10	11.10				
75 x 75 x 12	16.70	13.10				

Note: 1. Tolerance between gross weight and calculated weight at the time the goods are delivered should not be more than five per cent.

2. The calculated weight is computed by specific gravity of 7.85.

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Table No 10-81

Specifications For Light Rails

Classification	Maximum tolerance (mm)				
	Top	Bottom	Height	Tread	Length
8 kg	± 0.5	± 1.0	± 0.5	± 0.5	± 20
17 kg	± 0.75	± 2.0	± 0.5	± 0.5	± 20

Remarks: Light rails of not more than 0.75 tolerance in the hole for fish plates is considered first-class product; and that of not more than 1.5 is considered second-class product.

Table No 10-82

Specifications For Steel Blooms

Side length (Corss-section)	Maximum tolerance	
	First-class product	Second-class product
82 mm	± 3.0	± 5.0
92 mm	± 3.0	± 5.0

Note: The production of steel blooms of 92 millimeters in thickness was not as yet confirmed in spring 1953.

Table No 10-83

Specifications For Small Bar Steel Material

Diameter (mm)	Maximum tolerance	Cross-sectional area (mm^2)	Weight (kg/m)	Remarks
8		50.3	0.39	Eight-millimeter and nine-millimeter steel for wire rods
9		63.6	0.499	
12	±0.5	113.1	0.888	Including others, measuring rod is 5.5 meters
16		201.1	1.58	
19		283.5	2.23	There is a tolerance of ± 50 mm to every meter
22		380.1	2.98	
25		490.9	3.85	
28	±0.75	615.8	4.83	
32		804.3	6.31	

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Table No 10-84

Specifications For Medium Bar Steel Material

Diameter (mm)	Maximum tolerance	Cross-sectional area (mm^2)	Weight (kg/m)	Remarks
38	± 0.75	1,134.0	8.90	Length tolerance for average user is ± 60 millimeters
44		1,520.5	11.396	
50		1,963.0	15.41	
55	± 1.0	2,376.0	18.65	
60		2,827.4	22.20	
65		2,318.0	26.00	
70		3,348.5	30.20	
75		4,417.9	34.70	
80		5,026.6	39.50	

Doc No 90225 (10) (PB)

Table No 10-85

Specifications For Carbon Steel

1. Chemical composition

Product code	Carbon	Silicon	Manganese	Sulphur	Phosphorus
C 0	Maximum 0.10	Maximum 0.05	0.30 to 0.50	Maximum 0.050	Maximum 0.45
C 1	0.10 to 0.15	1.10	0.30 to 0.50	" "	" "
C 2	0.15 to 0.25	0.10 to 0.20	0.30 to 0.60	" "	" "
C 3	0.25 to 0.35	0.15 to 0.30	0.60 to 0.90	" "	" "
C 4	0.35 to 0.45	0.15 to 0.30	0.60 to 0.90	" "	" "
C 5	0.45 to 0.55	0.15 to 0.30	0.60 to 0.90	" "	" "
C 6	0.55 to 0.65	0.15 to 0.30	0.60 to 0.90	" "	" "

2. Physical nature

Product	Marker	Nature of steel	Tensile strength (kg/cm^2)	Elongation (per cent)	Usage
C 0	Indigo	Mildest steel	30 to 37	30 or more	Both mildest and very-mild steel are suited for wire drawing, pipes, communication wires, sheet steel material, construction materials, nails and rivets, and plumbing fixtures
C 1	Indigo	Very mild steel	34 to 40	25	
C 2	Yellow	Mild steel	37 to 45	22	Both mild and semi-mild steel are suited for manufacturing nails, structural steel materials, and screws
C 3	Red	Semi-mild steel	42 to 52	20	
C 4	White	Semi-hard steel	49 to 61	15	Both semi-hard and hard steel are suited for manufacturing forged steel farm implements, screws and axles
C 5	Green	Hard steel	58 to 65	12	
C 6	Red white	Hardest steel	62 to 75	8	Hardest steel is suited for manufacturing forged steel rail fish plates, axles, crankshaft, and shock-proof equipment and parts

Table No 10-86

Specifications For Pig Iron

1. Chemical composition

Product	Silicon	Manganese	Sulfur	Phosphorus
Basic open-hearth pig iron No 1	Maximum 1.00	0.8 to 1.50	Maximum 0.05	Maximum 0.5
Basic open-hearth pig iron No 2	1.00 to 1.25	"	" "	" "
Basic open-hearth pig iron No 3	1.25 to 1.50	"	" "	" "
Foundry pig iron No 1	2.75 to 3.50	0.50 to 1.00	" "	
Foundry pig iron No 2	2.00 to 2.75	"	" "	
Foundry pig iron No 3	1.50 to 2.25	"	" 0.06	
Converter pig iron	3.50 or more	"	" 0.04	

Table No 10-86 (Cont'd)

2. Quality and usage

Item		Quality and usage
Basic open-hearth pig iron No 1		It contains silicon and a small amount of sulfur. It is solely used in steel manufacture
Basic open-hearth pig iron No 2		
Basic open-hearth pig iron No 3		
Foundry pig iron No 1	Indigo	Being a soft iron, it can be shaved. It is suited for casting various types of machine parts and cast metal pipes
Foundry pig iron No 2	Yellow	It is suited for manufacturing iron pots for civilian use, water turbine for generators, and farm implements
Foundry pig iron No 3	White	Various types of stoves and castings
Converter pig iron	Red	

Table No 10-87

Organizational Setup of the Production and Technical Section of the T'ai-yuan Iron and Steel Works
(End of the first quarter of 1953)

Classification	Principal duty	Number of person	Personnel setup
Production team	Drafting production plans and regulating work progress	14 to 15	Person in charge, assistant engineer and 12 to 13 office workers
Technical team	Guidance and study of production technique	12 to 13	Person in charge, assistant engineer and special technicians
Rationalization and recommendation team	Studying and selecting proposals and actual survey of their effect	6 to 7	Person in charge, administrative staff members and technicians (few)
Total personnel		35 to 40	

Table No 10-88

Organizational Setup of the Technical Supervision Section of the T'ai-yuan Iron and Steel Works

(End of the first quarter of 1953)

Classification	Principal duty	Number of person	Personnel setup
Section chief	General control of operation	One	Person in charge: CHANG K'en-kung (STC 1728/5146/0501), 36 to 37 years old, ex-military man, Party member, hard worker and possesses ability to give technical guidance
Assistant section chief	Assist the section chief	One	
Coordinated judgment team	Coordination of physical tests and analysis	About 10	About 10 technicians (of which one detained Japanese engineer was repatriated)
Physical testing subsection	Various tests such as physical, metallogy and heat treatment	About 70	About 15 technicians (one detained Japanese engineer and three technicians were repatriated) About 50 workers
Chemical testing subsection	Various analysis on organic substance, pig iron and steel, coke and special steel	About 120	One engineer(A certain WANG /STC 3769/, graduate of Peiping University majored in applied chemistry, 37 to 38 years old) About 20 technicians (one Japanese detainee was repatriated) About 100 workers
Total personnel		About 200	

Note: Among the 44 Chinese technicians, about 30 were apprentice technicians who had just graduated from college.

Doc No 90225 (ID) (PB)

Table No 10-89

SECRET

Plan on the Work Index of the Blast Furnace in the Pig Iron Department (Plan No 1)
(1953 fiscal year)

	Item	1953 Plan			First quarter (January – March)					Fourth quarter (October – December)			Remarks
		Blast furnace No 1	Blast furnace No 2	Total	Blast furnace No 1	Blast furnace No 2	Total	Blast furnace No 1	Total	Blast furnace No 1	Blast furnace No 2	Total	
1	Effective working volume (cubic meter)												
2	Rated tonnage (ton)												
3	Calendar days (hour)												[illegible]
4	Work stoppage owing to cold repair (hour)												Number of hours necessary to conduct major repairs after blowing out the furnace
5	Designated working days (hour)												[illegible]
6	Work stoppage owing to [illegible] repair (hour)												[illegible]
7	Operational days (hour)												[illegible]
8	Operational days and effective [illegible] volume (hour – cubic meter)												[illegible]
9	[illegible] of active working volume utilization coefficient (cubic meter per ton [illegible])												[illegible]
	1953 plan												[illegible]
	1952 budget												[illegible]
	[illegible]												
	[illegible]												
10	1953 plan												
	1952 [illegible]												
	Amount during the [illegible]												
11	Total [illegible] tonnage (ton)												[illegible] one year

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Doc No 90225 (10) (PB)

Table No 10-90

Plan on the Technical Requirement in the Pig Iron Department (Plan No 2)
(1953 fiscal year)

Item		1953 Fiscal Year			First quarter (January - March			Third quarter - September)		Fourth quarter (October - December)			Remarks
		Blast furnace No 1	Blast furnace No 2	Total	Blast furnace No 1	Blast furnace No 2	Total		Total	Blast furnace No 1	Blast furnace No 2	Total	
Effective working volume utilization index	1953 plan												
	1952 budget												
	During the best month in 1952												
Percentage meeting specifications	1953 plan												
	1952 budget												
	During the best month in 1952												
Operating rate	Same as above												
Effective operating rate	Same as above												
Yield	Same as above												

POOR ORIGINAL

Doc No [illegible] 5 (20) (CB)

Table No 10-91

SECRET

Plan on the Quality of Products in the Pig Iron Department (Plan No 3)
(1953 fiscal year)

Type		Item		1953 fiscal year			First quarter (January – March)			Third quarter		Fourth quarter (October – December)			Remarks
				Blast furnace No 1	Blast furnace No 2	Total	Blast furnace No 1	Blast furnace No 2	Total	Blast furnace No 2	Total	Blast furnace No 1	Blast furnace No 2	Total	
Quality [illegible]	Pig iron [illegible]	Percentage meeting specification	1953 Plan												
			1952 Target												
			During the [illegible] in 1952												
		[illegible] specification													
			Same as above												
		[illegible]													
			Same as above												
[illegible]	[illegible]	[illegible]													
			[illegible]												
		[illegible]													
			[illegible]												
		[illegible]													
			[illegible]												

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POOR ORIGINAL

Doc No 90225 (10) (PB)

Table No 10-92

SECRET

Plan on the Work Index of the Open-hearth Furnace in the Steelmaking Department (Plan No 1)

(1953 fiscal year)

	Item	1953 Plan				First quarter (January - March)					Fourth quarter (October - December)				Remarks
		Open-hearth furnace No 1	Open-hearth furnace No 2	Open-hearth furnace No 3	Total	Open-hearth furnace No 1	Open-hearth furnace No 2	Open-hearth furnace No 3	Total	Total	Open-hearth furnace No 1	Open-hearth furnace No 2	Open-hearth furnace No 3	Total	
1	Effective hearth area (square meter)														
2	Rated tonnage (ton per charge)														Rated tonnage for each tapping
3	Calendar days (hour)														365 days x 24 hours = 8,760 hours
4	Work stoppage owing to cold repair (hour)														
5	Designated working days (hour)														Item three - item four
6	Work stoppage owing to hot repair (hour)														
7	Operational days (hour)														Item five - item six
8	Number of hours for each heat (hour)														
9	Tapping frequency (frequency)														Item seven ÷ item eight
10	Effective working volume utilization index (ton per cubic meter per day)														
	1953 plan														
	1952 budget														
	Amount during the best month in 1952														
11	Amount tapped for one operational day (ton)														Item one x item 10
	1953 plan														
	1952 budget														
	Amount during the best month in 1952														
12	Total tonnage tapped (ton)														Total amount tapped during each quarter period and one year

SECRET

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Doc No 90225 (10) (PB)

Table No 10-94

Plan on the Quality of Products in the Steelmaking Department (Plan No 3)
(1953 fiscal year)

Product		Item		1953 Fiscal year				First quarter (January - March)			Third quarter (July - September)		Fourth quarter (October - December)				Remarks
				Open-hearth furnace No 1	Open-hearth furnace No 2	Open-hearth furnace No 3	Total	Open-hearth furnace No 1	Open-hearth furnace No 2	Open-hearth furnace No 3	Open-hearth furnace No 3	Total	Open-hearth furnace No 1	Open-hearth furnace No 2	Open-hearth furnace No 3	Total	
Ordinary steel (mixed steel)	Carbon steel	Percentage meeting specification	1953 plan														
			1952 budget														
			During the best month in 1952														
		Percentage not meeting specification															
			Same as above														
		Percentage of product ...															
			Same as above														

Doc No 90225 (10) (FB)

Table No 10-95

Monthly Operating Plan for the Steelmaking Department (Product plan ton, operation plan ton, difference ± ton)

Date: Month	Date: Day	Time for each smelting	Operational time	Furnace repair time	Number of [illegible]	Open-hearth furnace No 1 [illegible]	[illegible]
	1						
	2						
	3						
	4						
	10						
	[illegible]						
Total							

Date: Month	Date: Day	[illegible]
	1	
	2	
	3	
	4	
	30	
	31	
Total		

Doc No 90225 (10) (PB)

Table No 10-96

Base Pay by Position Class at T'si-yuan Iron and Steel Works
(End of the first quarter of 1953)

Pay grade	Administrative workers	Technicians	Shop workers	Base pay
1		Master engineer		
2	First class director			About 1,200 Fen
3		First class engineer		About 1,150 Fen
4	Second class director	First class senior technician		
5		Second class engineer		About 1,000 Fen
6	Department chief	Second class senior technician		
7	Assistant department chief			
8		Third class engineer		
9	Section chief	Third class senior technician		
10		Fourth class engineer		
11	Sub-section chief	Fourth class senior technician		
12		Fifth class engineer		
13		Fifth class senior technician		
14		First class technical worker		
15		Second class technical worker		
16		Third class technical worker		
17		Fourth class technical worker		
18		Fifth class technical worker		
19		Apprentice technical worker		
20			Eighth class worker	About 350 Fen
21			Seventh class worker	
22			Sixth class worker	
23			Fifth class worker	
24			Fourth class worker	
25			Third class worker	
26			Second class worker	
27			First class worker	60 Fen

Note: 1. There were 32 pay grades at this works, but grades 28 and lower are unknown. Moreover, it was impossible to clarify fully the pay grades of the administrative personnel.

2. It is also reported that there were six classes each for the engineers, senior technicians and technical workers.

3. The first class workers were apprentices.

Doc No 90225 (10) (PB)

Table No 10-97

Principal Equipment of the Yang-chuan Ironworks

Name		August 1945 (At the end of the war)					End of first quarter of 1953				
		Type	Number	Working volume (cubic meters)	Rated capacity	Rated capacity (annual)	Type	Number	Furnace volume	Rated capacity	Rated capacity (annual)
Pig-iron manufacturing	Small blast furnace		One	55-60	20 tons a day	7,500 tons	Same	One		20 tons a day	1953, estimate 27,000 tons
		Nittetsu type	One	64	25 tons a day	6,000 tons	Same	Two		25 tons a day	1953, estimate 57,600 tons
	Hot-blast stove	Iron pipe type	Four				Same	Seven			
	Blower	Piston type	Two		One [illegible] One [illegible]		Same	Two		Same	
	Hoisting equipment		Two					Three			
	Pig bed		Complete set					Complete set			
	Ore storage		Complete set					Complete set			
	Clamp coking oven		10					[illegible]		Not yet in operation	
Iron casting	Cupola		Two		2.5 tons per heat	1,200 tons		Two		2.5 tons per heat	[illegible] tons (?) (TN [illegible])
	Pipe casting equipment	Pipe diameters: three to 12 inches	Complete set				Same	Complete set			
Workshop	Lathes, millings and others		27					7			
	Motor	Diesel	One		[illegible] hp		Same	[illegible]		[illegible]	
Accessory equipment		Completely equipped [illegible], transportation [illegible]									
Mill shop		Complete set of [illegible]									
Remarks		1. Rated capacity (annual) was computed on the basis of [illegible] operating days [illegible] 2. Actual capacity (annual) was computed on the basis of [illegible] operating days and [illegible] coefficient of [illegible] (cubic meters per ton a day) for blast furnaces. The working volume was [illegible]									

Table No 10-98

Pig-iron Output at the Yang-chuan Ironworks

Classification	1940	1941	1942	1943	1944	1950	1953 (plan)
Number of blast furnace	25 tons: one	Same	Same	Same In October one 20-ton furnace was added	25 tons: one 20 tons: one	25 tons: one 20 tons: two	Same
Output of pig iron	7,000 tons	7,000 tons	10,000 tons	12,000 tons	14,000 tons	About 46,800 tons	About 84,600 tons
Remarks	1. The years from 1940 to 1944 are Japanese fiscal years. 2. The years 1950 to 1953 are calender years. 3. All are accepted pig iron. Planned output for 1953 was estimated by setting the effective utilization coefficient at 0.8 (cubic meters per ton a day).						

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